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EDITORIAL NOTES.

Gas Companies as Colliery Owners.

THE current position of coal prices to large and constant users of the raw material such as gas undertakings is a matter of persistent administrative anxiety; and there has been no meeting of a prominent gas company the last few weeks at which the subject has not been in the forefront of the addresses to the proprietors. It was so at the meeting of the new Wandsworth, Wimbledon, and Epsom District Gas Company; and, on this occasion, the Chairman (Mr. H. E. Jones) leaped far beyond any of his compeers in private gas enterprise, though not in municipal gas enterprise, in making a proposal for suppressing for the gas industry the violent oscillations of coal prices which prevent the companies rendering the best possible public service. Mr. Jones takes an independent attitude in this matter, which is one not of party but of national politics. He is against the nationalization of coal mines. Most of us are opposed to State ownership of a commodity; and such advocacy can be left to the communistic extremists. We do not think that anything has been said from any high place in the gas industry that is open to the interpretation of any such advocacy. Sir Corbet Woodall has, in effect, asked the question why the coal industry should not be placed on an equality with the gas industry in the matter of legislative regulation, so that the country should not be at the ungoverned mercy of the coal monopolists, any more than gas consumers are allowed to be subject to the uncontrolled discretion of private gas administrators. Again, Mr. Jones is not favourably disposed to the people and the industry of this country being protected by the possible curtailing of export through the medium of a tax. There he differs from Sir Corbet Woodall, Mr. Charles Carpenter, Mr. Charles Hunt, and many others in the gas industry. Of course, his answer will be that he does not believe the effect would be the one intended, notwithstanding the struggle that the coal owners made to have the tax removed when formerly imposed, and notwithstanding the preferential treatment meted out to foreign buyers of British coal by the owners during the first weeks of the resumption of mining after the never-forgettable strike of 1912. His idea is that something much more drastic than any other proposal lately put forward is worthy of consideration. It ought, in his opinion, to have been an accomplished fact before this; but "better late than never." The gas companies, or at any rate the large ones who consume millions of tons of coal per annum, ought, in his view, to be in possession of some of the coal measures, so that coal could be obtained at practically cost price, and not be subject to any arbitrary rate of profit that the coal owners think fit to superimpose upon cost.

That is the proposal of Mr. Jones. It is an ambitious, but a discussable, one, coming from a large and old coal buyer. It is not new, save in its application to gas companies. The same idea has been brought to the surface at intervals in connection with municipalities; but it has always remained an amorphous sort of thing—never developing beyond vague conception. A national evil, it may be argued, requires a drastic remedy; but we are inclined to think that Mr. Jones' proposal is one that is so drastic as to remove it, under the advanced conditions of the times, outside the pale of practicability. It seems rather late in the day to begin to talk of acquisition for the benefit of a single industry. But still, as we have said, the idea is a discussable one; and the coal owners themselves, by their excesses, give greater excuse for considering every proposition, however unattainable it may at first sight appear to be. The case that Mr. Jones would present in favour of his scheme is a tripartite one. The first part is the abuse by the coal owner of his monopolistic position. Said Mr. Jones: "We have "some long-headed gentlemen in this coal business who "take good care of the law of supply and demand, which "means in the case of the gas undertakings that we have to "pay as much as these gentlemen think fit to get." That is a nasty slap at the inability of the law of supply and demand to claim to be a just controller of prices in the prevailing coal-supply situation. Coal is a necessity; but its supply is under the entire control of a comparative few. The law of supply and demand, behind which the coal owners take refuge in defending their actions, is crippled by the fact that, from their dominant position, they can regulate supply practically as they choose; and, as they are the only people with coal to supply, they alone determine what price the demand of the time justifies, and, as is suggested, the determination does not fail nowadays to err on the side of personal generosity. It is idle to talk of the regulating power of the law of supply and demand under such conditions as these.

That is one side of the case that Mr. Jones would put forward in favour of the gas industry having conferred upon it powers of ownership of coal measures. The second side of the case is that—as gas companies are public servants controlled in the matter of price and dividends by Parliament, and as the thousand-and-one uses to which gas is now applied demand that it shall be cheap and not be irregular in price—the business should not be subject to a law that is rendered largely inoperative in regard to coal by very special circumstances. The third part of the case is that in no process are the valuable properties of the coal brought to the service of the community with less waste than in the process of gas manufacture. This is a matter upon which one could enlarge at length. However, the three parts form a very good case; but would it carry Parliament, if a concrete scheme were placed before it for putting the gas industry in possession of coal measures for meeting their requirements? We doubt it. The coal interests would not be the only opponents, but other industries would claim that the removal from the coal market of one of the largest coal-consuming industries of the country might, as things now exist, prejudicially affect the rest of the coal consumers. A less ponderous and more feasible method of preventing violent fluctuations of prices is that suggested by Sir Corbet Woodall, of making the coal owners liable to laws or regulations other than the law of supply and demand, which the coal owners have shown is rendered nugatory by the special dominating circumstances of their position.

While on this subject, brief allusion may be made to the letters by "Coal Fitter" and "Merchant" that have appeared in the last two issues of the "JOURNAL," which letters are the best possible arguments the gas industry could wish for in support of a claim to the existing coal conditions being regulated, in order that the British people and the industries of the country might be protected against the extortionate propensity of the few. The writers of the letters well illustrate the absolute attitude taken up by the coal owners. They seem to think that the rest of the country ought to sit still while they exercise their arbitrary rule. One of the correspondents says: "What we in the "North cannot understand is why the coal owner, the coal "miner, and all the multifarious interests allied to coal "mining should be subjected to undue pressure, in order "that the London Gas Companies may reduce the price of "gas to their consumers." What we cannot understand is why the coal owner should be allowed to exercise his will in the matter of price to so inordinate a degree that the rest of the country is made to suffer. In his letter, "Merchant" accentuates, with unconscious vigour, the unrestrained appetite of the coal owners for making the fullest use of their powerful and unregulated position. "Why," he asks, "should the Government take money out of the pockets of "the coal owners and miners, and further inflate the profits "of the Company [the Gaslight and Coke], who, by their "monopoly, already enjoy a privileged position." Who hold the larger monopoly and privileges—the coal owners or the

gas companies? The gas companies have no monopoly in light, heat, or power. They are the subjects of competition in every direction—even in residual products. Whatever profits the sliding-scale companies make cannot be participated in by the shareholders to the extent of (say) a one-sixth part until they have given the gas consumers the other five-sixths. The gas companies are rendering a public service, in which the profits that are made from the public are shared by the public.

What, in contrast, is the position of the coal owners? They hold a complete monopoly of coal; and the ideal of public service at a fair profit is rejected by them in favour of rendering the best possible service to their own pockets. Mr. Carpenter, in his reply to "Coal Fitter," urged those holding the monopoly of coal not to strain too much the advantage of their position. But that is exactly what they are doing, and by so doing have shown that in this matter they owe no allegiance or responsibility to national interests. Our "Merchant" correspondent last week (if he is to be taken literally) gave birth to an argument in favour of the coal owners not only squeezing all they possibly can out of the gas industry, but grabbing all the enhanced profits that the wise administration of gas undertakings can secure from their bye-products. That is what his argument really amounted to. No one but the coal owners is to enjoy any benefit from any improved trading by the gas industry. Why should they study gas consumers whose patronage of gas provides such a good class trade to the collieries? Truly, ungoverned monopolistic greed was never better illustrated; and the suggestion that, as the gas industry is regulated, so should some regulation be placed upon those who work and deal in our native coal possessions receives the strongest support from a defender of the coal owners. Why should not the Government protect the public who enjoy the larger part of any additional profits made by the gas companies against the excesses of the private coal owners? This question is the best answer to the one in which "Merchant" speaks of the inflation of the profits of the Gaslight Company. The merit of the claim of the gas companies lies in their regulated relations with the public. In what direction does the merit of the claim of the coal owners lie that they should remain unrestricted by the Legislature in their dealings in coal? Is it to be found in the conditions that have existed for home industries and the public ever since the coal strike ended?

High-Pressure Gas and Flame Arc Lamps as Run in Manchester.

THE paper that Mr. S. L. Pearce and Mr. H. A. Ratcliffe read at the meeting of the Institution of Electrical Engineers last Thursday is remarkable in many respects; and the contribution, taken as a whole, is a complete failure as affording any reliable guide in connection with the central aspect of the important subject upon which it treats. In candour, the authors blow hot and blow cold. They treat of Manchester conditions only; and truly, in this matter of street lighting from the side of gas, Manchester has proved itself a very unworthy source of information, principally for the reason that, as Mr. Haydn Harrison said in the discussion, where high-pressure gas-lamps are properly installed, something like double the efficiency obtained from the Manchester lamps is realized. The authors omit to make pronounced reference to this, or to point out emphatically that at the very base of their conclusions is the grave defect of an avoidable inefficiency—avoidable had the installation been placed in the right hands. They admit many things that are favourable to gas in respect of quality and of distribution as visually determined; but when actual measurements are made of the latter by electricians, it appears that first impressions partake somewhat of optical illusions, and that flame arcs do much better. While in passing there is something good to be said of high-pressure lamps giving only an efficiency of 27 candles per cubic foot of gas consumed, in the end the authors find them practically all that is bad. While flame arc lamps lead off by being radically bad, the Manchester Electricity Department has, of course (according to the authors of the paper), found the means of making them surprisingly good. And the final result is that high-pressure gas-lighting is (also according to the authors), out of the running for street illumination, and flame arc lighting has nothing to do but to walk into possession of the streets. Our inspection of the trial lighting in the streets of Manchester does not confirm Messrs. Pearce and Ratcliffe's views and conclusions on many points, notwithstanding the low efficiency of the high-pressure lamps there, through the character of their installation. There were no doubt many, too, in the audience last Thursday who were convinced, from their own observation and experience, that for them the proof of the supremacy of flame arc lighting has not been made much easier by the studied efforts of their Manchester colleagues.

The matter of these Manchester tests was very fully discussed at the time the reports of Messrs. Jacques Abady and Mr. Haydn Harrison were published in our columns, one of the cardinal features of which reports was that, though the candle power of the high-pressure gas units was considerably below that of the flame arc lamps, the minimum illumination at the testing level in the streets was practically equal. In view of the previous criticism, there is no occasion to do much more now than leave the extracts (published in other columns) from Messrs. Pearce and Ratcliffe's paper and the discussion to speak for themselves. There are, however, a few general points upon which there may be remark. The authors state that the lighting in Princess Street and Portland Street may be taken as typical examples of modern street lighting by high-pressure gas-lamps and high candle-power flame arc lamps. We are sorry to have to disagree with them—in respect of the high-pressure lamps for the reason already given, and in respect of the flame arc lamps, because what the Electricity Department has doneto secure better distribution, and to try to effect a diminution of the shadows thrown by the lamps, has removed farther than ever from scientific illumination what is to be seen in Portland Street. The authors are very critical on the subject of the efficiencies claimed by the makers of high-pressure gas-lamps; and they back-up their condemnation by what is found in Manchester. The makers of high-pressure gas-lamps claim their efficiencies for lamps properly, and not improperly, installed; and it is found that their claims are not far (if at all) in excess of the mark when the lamps are treated in the manner for which they were designed. It was too much to expect of the authors that they should recognize this. Absolutely vital to efficiency—and this is more important than all the authors' surmises about fog and smoke-laden atmosphere playing serious havoc with the efficiency of mantles—is the delivery of the gas to the burners at the pressure to which they are regulated.

There might have been equally emphatic condemnation, and with more reason, of the candle-power and efficiency claims of the makers of flame arc lamps. Condemnation can be found by a careful reading of the paper; for with all the nursing that flame arc lamps have received in Manchester, they have never, as supplied by the manufacturers, reached, by a substantial amount, the candle powers and efficiencies accorded to them. All flame arc lamps are not nursed and globed as are those at Manchester; and therefore all flame arcs in existence that are not similarly treated suffer from the defects which Mr. Pearce experienced in connection with the flame arcs as first adopted by him for the trial. It has been a wearisome business for him to try to eliminate those defects—defects in the matter of shadow and unequal distribution—and to approach nearer the superlative quality of high-pressure gas illumination. He has only partially succeeded. Such success as he has achieved has been secured by accentuating the other disadvantages of flame arcs, in respect of glare, and the intensifying of the shadows thrown upon the streets by vehicular and pedestrian traffic. The penalty paid in this regard is seen better by a visit to Portland Street than by anything that can be gathered from the paper. No value consideration in the matter of higher quality of illumination is given in the paper to the high-pressure gas-lamps, though in most commercial transactions quality usually counts. We are glad to see that Mr. Pearce sacrifices the reflectors that he put on the top of certain of the flame arc lamps for the purpose of assisting him in mitigating the shadows on the roadway immediately below the lamps. The dense gloom that those reflectors gave above the line of the lamps was very depressing. It is thought by some that the flame arc lamp makers have been perpetrating a mistake in the design of their globes; but we are not so sure after this Manchester experience that they have done so. Given the choice, we should prefer the shadows and the disuniform illumination to the intensifying of glare and harshness by the use of clear glass globes merely etched at the bottoms to secure slight obscuration. The authors also assert that the Portland Street lighting looks much warmer and more cheerful than that of Princess Street. That is a matter of opinion and taste; and our opinion and taste are

totally at variance with those of the authors. They do concede, however, that in the matter of quality of light, the high-pressure lamps are the superior of flame arc lamps, and that with them glare is not of that eye-straining character which is experienced with flame arcs, particularly when equipped with clear glass globes. To intensify these defects of electric lighting is not scientific illumination; and yet from scientific illumination the Electric Lighting Department of Manchester has been detracting in order to obtain what may be described as a stronger commercial position as to cost in relation to the quantity of measured illumination. There is one other point touching intrinsic value, and that is the penetrating power of the rival lamps in fogs. The authors state, without anything in the way of verification, that the flame arc lamps have greater penetrating power in foggy weather than the high-pressure. That is contrary to authoritative declarations and general experience.

In their desire to defame the high-pressure gas-lamps as much as possible, the authors also aver that, though the gas-lamps give a superior light, their candle power varies from day to day. Mr. Pearce, we remember, made the same statement in one of the reports that he presented to his Committee. He and his fellow author now say publicly that the candle power of a high-pressure lamp may fall at least 50 per cent., although the mantles are renewed, unless it is arranged to change only one mantle at a time, thus spreading the complete change over a long period. They are speaking of the multiple burner lamp here; and there is no sense in the statement. We should like Mr. Pearce to supply us with a little more of his wisdom, by saying how a high-pressure gas-lamp (having no mechanical working parts), served with the requisite governed pressure at the inlet to the lamp, and with mantles that are unfractured, can be depreciated in efficiency by as much as 50 per cent. These violent and extraordinary fluctuations of light to which the authors allude are not found in Westminster. If they are not found there, there is no reason why the same constancy should not be secured elsewhere. If Mr. Pearce has a substantial reason, he might enlighten us. The highest efficiencies can be maintained with high-pressure lamps if they are properly treated—high efficiencies combined with the superior quality of illumination which Mr. Pearce and his co-author agree is on the side of gas-lighting. While the authors talk of fluctuations of the candle power of high-pressure lamps, and do so in the spirit of exaggeration (using experience with known defectively installed lamps) they make light of the changes in illuminating power in flame arc lamps, produced by the flickering, the falling of ash into the globe, the grimy state into which the globes soon get through the conditions inside and the smoke-laden atmosphere of Manchester outside—from all those up to total extinction through a hundred-and-one causes.

The folly of the companionship of dogmatism and inexperience is placed on record in the paper when the authors deal with the disadvantages of high-pressure gas-lamps. The first disadvantage is an extensive and highly dangerous leakage of high-pressure gas. We hardly expected to find any engineer in these days putting forward such a disadvantage as inseparable from the conveyance of any high-pressure fluid. Why need there be an extensive and dangerous leakage of high-pressure gas? There is no difficulty in conveying it without extensive and dangerous leakage; and it is because the gas was not so conveyed between the compressor and the lamps in Manchester, that the latter did not get the pressure for which they were designed. Then another phenomenon has been discovered by the authors. It is that fogs and the smoke-laden atmosphere of Manchester result in a serious diminution of candle power of the high-pressure source of light just at the time when it is most required. Mr. Pearce was asked for an explanation as to this phenomenon. He thinks it is due to the fog and smoke choking-up the burners and mantles by deposit of carbon. And this with gas flowing at high pressures, and the flame temperature to which the mantles are subjected! We rather think, if this were true, that more confirmatory evidence would be found in the bowls of the lamps. Another disadvantage is the partial or complete failure of the lamps in frosty weather. Has Mr. Pearce had experience of a sagging flexible pipe in which there has been condensation? He must know that such pipes are not often used with high-pressure gas-lamps. The triviality surrounding these points of so-called disadvantage is too obvious to call for further comment.

The question of cost is one that need not be discussed here. The costs quoted in the paper are, as was pointed out in connection with the reports of Messrs. Abady and Harrison, taken on bases peculiar to Manchester; and the Electricity Department was then apparently not prepared to divulge the bases of computation. The figures were not discussed to any extent at the meeting of the electricals; the view probably being that the less said about them the better. Certain it is, from an observation by Mr. Pearce, that in the costs there is no profit for the Electricity Department. Taking the paper as a whole, the weakness of it in its attacks on high-pressure lighting is strongly marked; the many vulnerable points in flame arc lighting have been further exposed by the authors. The obligations of the gas industry are due to Mr. Pearce and his collaborator.

Gas and Heat Treatment of Metals.

The Glasgow Corporation Gas Department has set itself seriously and methodically to develop the use of gas in industry; and Bailie Paxton, the Convener of the Gas Committee, with his colleagues, and their technical adviser, Mr. Alexander Wilson, are doing their utmost towards this end. Among their plans is (as in Birmingham) a laboratory to be specially devoted to the work of ensuring the attainment of what is required in any branch of industrial operation. Other active procedure is the delivery of lectures by men of experience in the development of the gas-furnace. The latest lecture of this kind was delivered, at the Glasgow Royal Technical College, by Mr. J. Lord, of the Manchester Furnace Company, Limited; and it is reproduced in other columns. Credit must be given to the lecturer for the care he exercised in dissociating, as far as possible, his private commercial interests from what he had to say, although we should have liked to have seen more included in the lecture regarding the use of high-pressure gas with air at normal pressure. But the little that was said was not altogether unfavourable.

This apart, Mr. Lord's lecture is valuable for the comparative tables of costs with various fuels; and we believe that these will often be quoted in the campaign for increasing the business in gas for industrial heating. Gas stands well, combining cost and intrinsic value, in all operations for doing a certain quantity of work in the treatment of metals. In this work, there are advantages on the side of gas which, if they cannot be expressed in such exact figures as the cost of the fuel, have a very real and substantial value. Look at the figures in most of the tables; and it will be seen that town gas with air blast not only stands in good position in the matter of economy for doing a given amount of work, but the time occupied in attaining a high temperature is shortened in comparison with solid fuel, producer gas, and town gas with ordinary draught furnaces. The process of annealing especially shows this; for while by means of oil the necessary temperature is reached in three hours the same as with town gas and blast furnace, the cost for annealing ½ ton of steel is 2s. 4d. with oil, as compared with 2s. for town gas and air blast. The Bonecourt furnace, however, claims an equality in the matter of the three hours, while the cost is 1s. 8½d. The time factor is an important one in industrial operations; for it represents increased output. The cleanliness, too, of town gas, the ability to regulate and maintain the temperatures, with low cost of labour and responsibility, all contribute to works' efficiency. The accuracy of these statements, as well as the cost figures given in the lecture, are easily demonstrable.

With the size of furnace taken in the illustration for case-hardening, gas does not, in respect of cost, come out so well as some of the competing fuels in arriving at a temperature of 1000° C. But in reaching this temperature, there is a saving of time as compared with solid fuel and producer gas; and the extra fuel cost is more than compensated by advantages to which no definite figure can be attached, but which are profitable in contributing to works' efficiency and output. So we go on finding the advantages of gas receiving excellent certification throughout the lecture. The lecturer does not claim that the blast type of furnace should be used for all temperatures. Up to 800° C., he finds that the natural draught furnace can be run with the same economy as the blast type; but, if anything, he errs a little in his favour towards the latter. It does not require a very great stretch of memory to recall a lecture in Glasgow where natural draught furnaces working up to and above 1000° C. were spoken of in high terms. The high-pressure gas system of furnace heating is, it is freely acknowledged by

Mr. Lord, making considerable headway; he admits that for some purposes it works exceedingly well. His praise, however, is not of the complete character that we could guarantee would issue from Birmingham and the Woolwich Arsenal. For melting type, he asserts that it is not so good as gas with the air under pressure. It would be of interest if he would extend his comments, and tell us why not, as there is a very large experience available in this particular branch of work with high-pressure gas. However, in a hardening test included in the lecture it is shown that it required 20 cubic feet of gas less per hour to maintain a temperature of 1000° C. with gas under pressure than with gas at normal pressure and air under pressure. But it took longer to do the work. This will seem to those without experience to be another point that requires a little explanation, assuming equality of furnace temperature. The advocates of high-pressure gas for furnace work put forward, from experience, certain advantages over the air-blast furnace—one of them being the greater certainty of maintaining the temperature required. In this particular matter, Mr. Lord was treading on controversial ground; but he did not commit any great trespass, so that he does not lay himself open to very severe attack. His lecture, however, is one that will be filed for use in prosecuting the development of the industrial branch of the gas business; and it will certainly be found valuable.

Modern Traffic and Pipe and Tar Work.

THE recently issued annual report of the Metropolitan Committee on Materials and Means of Paving the Streets of London (of which Committee Mr. Alpheus C. Morton is the Chairman), is a document of educative value, in that it discloses, among other things, how modern traffic is affecting the construction of the roadways, and how tar-spraying of roads has assisted to local economy. The effect of modern traffic upon increased structural cost is being felt in the Metropolis chiefly in those miles and miles of arterial thoroughfares in the different boroughs that are paved in various ways—mainly by wood blocks. The effects are of a kind that will not be palatable to those who have distribution property beneath the concrete foundations of such roads. In most boroughs, the practice under the old conditions of traffic was to construct a Portland cement or concrete foundation of about 6 inches thickness; but from the borough reports included in the document before us, there is scarcely one in which reference is not found to the disintegration of the shallow concrete foundations by the perpetual vibration that now goes on. This vibration extends laterally over large areas. In our offices in Bolt Court, the tremors occasioned by the motor buses in Fleet Street are distinctly felt. If the vibrations cause so much disintegration of 6-inch concrete foundations, and they have persistent effect so far afield from the line of running of the motor buses, the same vibrations must have a prejudicial effect on the pipe work and culverts just underneath the foundation of the roadway. Things are getting worse, instead of improving, in the amount of this particular form of traffic. Naturally with the disintegration of the road foundations proceeding, the borough authorities have had to adopt some means of strengthening them; and in report after report we find that, whenever opportunity arises, there is an increase in the thickness of the concrete foundations from 6 to 8, 10, or 12 inches, and in one case a thickness of 13 inches is mentioned. Of course, in London where this form of road is the fashion, the conditions have fairly well settled down for gas and water pipe owners; but when at any time they have to open up a length of roadway, they find the cost somewhat considerable of breaking up the road-paving and penetrating the concrete. The difficulty and cost will be greater still where (say) a 12-inch concrete foundation is substituted for a 6-inch one. Our modern conveniences do not bring to us an unqualified economy. In this instance, the structural and maintenance expenses of paved roads are heavier to the localities and to those who use the subsoil for the accommodation of the means of distribution of other public conveniences.

There is another side to the report. It was the incoming of the new forms of road locomotion that initiated the dust nuisance, which soon became intensified, and was of such a character that a means of suppression had to be discovered. Tar-spraying was found to be the handiest and most effectual method; and this the authorities now recommend should be accompanied by the construction of stronger macadam road crusts in which a bitumen binder is used. The tar-spraying, however, has produced much economy in the annual charges for scavenging and watering. This is what the Committee say about it: "Considerable saving continues to take place "in those boroughs where tar-spraying of macadam roads "is largely undertaken. From the appended information, "it will be seen that a very considerable saving has been "effected in the boroughs of Fulham, Greenwich, Hammer-"smith, and Wandsworth, in the cost of scavenging, water-"ing, and maintenance of highways since the adoption of "the system of tar-spraying macadamized roads. It is, "moreover, generally agreed that a great improvement in "the road results from tar-spraying." This is testimony of value both to those responsible for the maintenance of roads, and those who have for disposal the commodity capable of such desirable dual effects as the suppression of a nuisance and the production of a local economy.

We turn to the "appended information," and find that Wandsworth furnishes the most complete example of the effects of tar-spraying. This work commenced in 1907-8, with the small expenditure of £156. The amounts spent since on tar-spraying have been: 1908-9, £1018; 1909-10, £2386; 1910-11, £3171; and 1911-12, £5597, with an additional £840 on second coating over part of the treated roadway. In the year prior to the advent of tar-spraying £35,959 was spent on road scavenging, and £10,082 on watering. Since then there has been a gradual, almost constant year-by-year, reduction in both items, until 1911-12, when the item for road-watering rose owing to the dry season. The actual reductions in costs are almost startling. In 1907-8, scavenging cost £31,338 and watering £7213; in 1908-9, the respective figures were £31,938 and £7369; in 1909-10, £30,549 and £6544; in 1910-11, £27,247 and £4349; and in 1911-12, £24,876 and £5035. Thus it is seen that, notwithstanding the changed character of the traffic, there was a reduction in the year 1911-12, compared with 1906-7, of about £11,000 on scavenging and £5000 on watering. Tar-spraying has been a good investment for Wandsworth; and the profits are such that, quite apart from local comfort, the Borough Council could not afford to return to the conditions that preceded the advent of the nuisance-suppressing and economy-producing road practice.

Coke-Oven Managers and Gas Organizations.

THE letter of "Coke-Oven Manager" in our last week's "Correspondence" columns is one which we hope will engage the consideration of the Council of the Institution of Gas Engineers and of the Committees of the District Associations. The suggestion contained in it would probably be promptly advanced if some of the coke-oven managers would send a formal communication on the subject to the Institution. The proposal is that it might be mutually advantageous if the ranks of our professional organizations were opened so as to admit coke-oven managers. It was pointed out, in an editorial article in the "JOURNAL" a fortnight ago, that the interests of the gas industry and of the coke-oven industry are being drawn closer and closer by the march of events. Both technically and commercially this is the case in the ways then indicated; and (until other views are forthcoming which would weigh against present opinion) we cannot see that anything but mutual good and interest could arise from professional fusion. There must be a large amount of technical interest in the matters of carbonization in bulk and the recovering and working-up of residuals for gas engineers to derive from the operations and experiences of coke-oven engineers and managers; and commercially, in the matter of residuals, interests are largely common, and can be better advanced by consolidation than by division. While the experiences of the coke-oven managers might prove helpful to the gas industry, so the experiences derivable by the former from the latter would be equally of advantage to them. Most of the producers of sulphate of ammonia in the coke-oven industry are subscribers to the Sulphate of Ammonia Committee. They are interested just as much as the gas industry in maintaining and enlarging the markets for sulphate of ammonia and other residuals, in order to secure the best possible prices. There can be more of mutual advantage by being brought into closer union than by the one industry keeping the other at arm's length. That at any rate is the present view; and substantial reasoning would be required

to alter it. The greatest progress is effected by making use of the best of the widest experience. On this ground alone, we bespeak sympathetic consideration of the suggestion of "Coke-Oven Manager." "I feel certain," he writes, "that "*all* coke-oven managers would be only too willing to have "the opportunity of coming into contact with gas engi- "neers." In the case of the Institution of Electrical Engineers, the membership is composed not only of men engaged in the town supply of electricity, but electric railway and tramway engineers, and telegraph and telephone engineers —in fact, anyone who is technically engaged in any industry in which electricity is the energy employed is welcomed in the ranks of the Institution. Our own Institution wants its basis broadened; and here is one way of doing it.

Antwerp Exhibition.

Our Continental friends have been showing considerable activity and enterprise lately in the matter of demonstrating, through exhibitions, the rapid advances that in all directions the gas industry has been making in the efficiencies of their gas-consuming appliances, and in refinement in application. There was the Women's Exhibition in Berlin in the spring of last year; there was the Amsterdam Exhibition in the autumn; now there is the International Gas Exhibition at Antwerp. This activity in demonstration is not due to any retrograde movement in volume of Continental gas business. On the contrary, as in this country, so on the Continent, the gas business is flourishing exceedingly; but the administrators of the Continental gas industry, as here, desire that the business shall secure the fullest possible measure of prosperity that merit can command. The splendid demonstration that is being made in Antwerp owes its origin and existence to the Imperial Continental Gas Association; and we are free to say, from personal inspection and part in the events associated with the display, that the rich realization of the objects of the exhibition is due to its masterly organization by the Manager of the Association at Antwerp, Mr. A. F. P. Hayman, well known to his British *confrères* as the erstwhile chief assistant of Mr. E. Körting, of Berlin. This is the first gas exhibition ever held in Belgium; and it has been, and will continue to be until it closes on the 24th inst., a veritable triumph. There are three things about a special trade exhibition of this kind that have to be kept prominently in front in the plans of organization. The first is that all possible vehicles of attraction shall be brought into play to tempt the public to pay a visit; the second is that the exhibition itself shall be of such a demonstrative character that the public, when there, will be both interested and instructed, and so be made the channels for the further circulation of interest; and the third is that the display shall be the means of encouraging both technical and commercial enterprise. The display at Antwerp fulfils all three conditions; and Mr. Hayman and those associated with the organization have to be heartily congratulated upon the fact and upon the effects. For months they bent their backs to the work; and the reward is in the solidly beneficial result.

International Rivalry.

We will not dwell here upon the ceremonial events associated with the opening of the exhibition and the visit last week of the members of the Belgian Gas Association, and professional men from other countries. Record has been made in our columns of the proceedings at the opening function; and elsewhere is an account of the interest attaching to last week's visit, when Mr Hayman found himself surrounded by many colleagues and friends. There is, however, a matter that is striking, arising out of the international character of the exhibition. British gas appliances were well represented there; and so also were those of other countries. To the gas man the point reminded of, and further impressed, the fact of the common interest that permeates a commercial industry such as that of gas supply, which relies for its permanent success upon technical achievements that will keep it ahead of its competitors in the matter of efficiency in service. The very fact of a dependence upon such achievement makes the gas industry give a universal welcome to real improvement from whatever quarter it comes, and among the makers of gas-using appliances a fresh success in one quarter acts as an excellent stimulus to efforts in all other quarters. So progress is benefited. No one country (we are rather glad it is so) can boast of a complete precedence in having contributed to advance in any one direction. The exhibits at Antwerp emphasize this. We know our indebtedness to the Continent for so much in connection with the pre-eminence of the gas industry in economical and hygienic lighting; we on our part have in producing advance in lighting turned to good account the fundamentals supplied from abroad. Antwerp demonstrated this. But we can claim that, in the matter of the applications of gas to domestic heating service, we have so far led. Antwerp likewise demonstrated this. But how long we are to be permitted to successfully maintain this claim, it would be dangerous to say. Our Continental friends have, in relation to their domestic heating appliances, had to face the severe criticism of the intrepid Mr. Körting, who naturally wants the best of appliances—the appliances that will give users the highest efficiency—for cultivating business, and does not care whence they come, though naturally he would prefer to see the best the product of home enterprise. The revision of radical principles and structural elements of Continental gas-fires is necessary to produce the required hygienic condition of radiant heat instead of convected heat, and for ensuring that products of combustion find emission by their proper route. The international display at Antwerp will, we are sure, invigorate enterprise and produce advance, to the benefit not only of the Continental gas industry, but, we hope, of our industry at home.

British Commercial Gas Association.

Some items of news regarding progress appear on another page. The recent campaign for adding strength to strength has had satisfactory result; for to the present time upwards of an additional fifty gas undertakings have been enrolled as subscribers. The activity that has been shown has been rewarded; and we hope the reward will be quickly supplemented. The General and Executive Committees look well ahead; it is their business to be ahead of, and not behind, the times. They have already decided that the second annual conference shall be held on Oct. 21 and 22 next at the National Gas Exhibition at Shepherd's Bush. The exhibition will make the occasion one of double interest. The spring advertising campaign is about to open with cooking and water-heating advertisements. Among the other items is an interesting announcement as to an International Committtee on Commercial Advancement in the Gas Industry; and there is also one that will have interest for the Electricity Publicity Committee. The British Commercial Gas Association have hardly yet been in operation a twelvemonth, and had all the preliminary work before them of preparing literature; but 1,303,450 copies of various leaflets, &c., have since been sold. We forget the exact nature of the boast made by the Electricity Publicity Committee in a recent issue of their Bulletin.

Gas Heating from the Public Platform.

Gas topics are occupying the public platform to-day more than they have done, and to the advantage of the gas industry. The more of this method of publicity, the better. The public require instructing; and the public can be instructed from the platform at greater length than is possible in advertisement or literature. Where some men and women will decline to spend an hour or two studying, for example, the literature of gas heating, they will sit and listen for the same length of time to the imparting *vivâ voce* of like information. But the people who attend lectures are of the minority, and it is a small minority; and so all the other means of communication with the public—such as advertisement, literature, exhibition, and demonstration—are essential to complete publicity. However, in two Cantor Lectures at the Society of Arts, Mr. F. W. Goodenough has secured a good public hearing upon the matter of gaseous heating; and while two Cantor Lectures do not afford much scope for comprehensiveness, Mr. Goodenough, it will be found, has brought together, in pithy style, those aspects of the subject that appeal most directly to the lay mind. To the professional gas man, the lectures will be more useful as models for style, lucidity, and character of material than for any really new light. They are addressed to the public; and for the public they are framed. It is a pity the same lectures could not be delivered from many other platforms. In the first lecture published *in extenso* in our columns to-day, Mr. Goodenough traverses the arguments in favour of domestic gas heating, and disposes of the arguments and ill-favour born of obsolete conditions. Towards the latter part of the lecture, he has a little tilt at the inverted nomenclature employed by some makers. Convectors are called radiators; and material which is incombustible is termed "fuel."

Mr. Goodenough prefers that a spade should be called a spade, and gas the perfection of a heating fuel. Regarding the fire-clay "fuel," he has a preference for the use of the term "radiants," which was originated by Mr. H. James Yates. The term has not come into general vogue; but when one thinks that more than half the heat is of the radiant variety, the title "radiants" for the incandescent material commends itself as apposite. The importance of the periodical cleaning of gas fires by competent men specially employed by the gas undertaking is a point in the first lecture. An annual cleaning in a district of which we have cognizance, keeps the fires in excellent condition.

Sidmouth Arbitration Award.

The suspense of the Sidmouth Urban District Council with regard to the price they would be called upon to pay for the undertaking of the Sidmouth Gas and Electricity Company, has now been put an end to, by the publication of the award in the recent arbitration, the proceedings in which were reported at length in the "JOURNAL" earlier this year. Four days were occupied in the hearing; there being a great difference in the figures put forward as the value of the concern on behalf of the buyers and the sellers. For the Company, Mr. Henry Woodall and Mr. J. Brearley submitted valuations of £49,130 and £50,254, including 10 per cent. for compulsory purchase. For the Council, Mr. E. H. Stevenson and Mr. Frank Jones put in valuations, both arriving at the same figure of £27,270. Points to which a good deal of attention was given during the arbitration were the working results and price of coal during the account year, the payment of a certain back-dividend, the consumption of gas in the public lamps, a bank overdraft, and the position of debenture holders. There had also to be taken into consideration the fact that the Company had obtained, but not yet exercised, powers to supply electricity. As to the 10 per cent. for compulsory purchase, it was agreed that the tribunal were to have a free hand. The multiplier taken by the Company's witnesses was 28½ years' purchase, and that of the Council's witnesses 20 years. The award fixes the purchase price at £34,683; and it is considered by the Council to be a favourable one—to them, of course. To the sum named, there will have to be added an amount for compensation to the officers of the Company, the expenses of the arbitration, and the costs incurred by the Company in the promotion of their Bill. At present, these latter items can only be estimated; but there seems to be no doubt that they will bring the total cost of the acquisition of the undertaking to a figure of considerably over £40,000.

Gas Supply in Melbourne

A gratifying record of business done during 1912 was placed before the proprietors at the half-yearly meeting of the Melbourne Metropolitan Gas Company. The sale of gas, as compared with the preceding year, showed the substantial increase of 10½ per cent., and the number of meters in use an increase of over 10,000. Some portion of the growth in gas sales is due to the pushing of the stove portion of the business, which has no doubt been greatly facilitated by the appreciably lower price of gas prevailing over the whole of the period dealt with. It will be noted that the Dessau vertical retort installation at the South Melbourne works, of which the Company had at the time of the meeting had six months' experience, has given results of a satisfactory character; and that with the bringing into work of the larger installation of similar retorts at West Melbourne, the proportion of gas manufactured on the vertical system will approach one-half of the total output. In view of all the circumstances, the Board are of opinion that the time has arrived when the dividend to the shareholders should be increased. Naturally, the Chairman, in the course of his address, had a good deal to say with regard to the report of the Gas Inquiry Board—a matter which is still receiving the careful attention of the Directors. The conclusions arrived at were at the time set forth in the "JOURNAL," and the report was the subject of an editorial criticism which was read at length by the Chairman, who added: "Surely these words convey a warning to those who would interfere with any investment made on the faith of an Act of Parliament." It appears that, on learning that it was the intention of the Government to give consideration to the recommendations of the Board of Inquiry, with a view to the introduction of legislation dealing with the matters referred to, the Directors wrote demanding that an appeal should be made to the Courts to determine the legality of the Company's actions on the charge brought against them, "before Parliament was asked to repudiate its own enactment." What is it that gives rise to the apparent disinclination of the Government to fall in with this suggestion?

And in Sydney.

Highly satisfactory progress was also recorded by the Chairman at the half-yearly meeting in Sydney of the Australian Gaslight Company. The increased consumption of gas for the period under review amounted to over 10 per cent.; while the number of consumers increased by 3000 during the half year. That gas-cookers and various other industrial and domestic appliances for the utilization of gas are extensively used, is shown by the fact that the day consumption is equal to the night. Reference was made to the provisions of the new Gas Act, under which the companies will have in future to work; and the consumers will be particularly interested in the announcement of the reduction in the price of gas to 3s. 6d. and 4s. 4d. per 1000 cubic feet for ordinary and prepayment consumers respectively. Cabled reports show that since the date of the meeting there have been serious developments of the labour agitation, which the Chairman remarked had been going on for some time; the men, who entered into a three years' agreement as lately as September, 1911, seeking to secure a variation of the award, so as to allow of them receiving increased pay. It seems that the Arbitration Court refused to vary the award, and a strike, which caused considerable inconvenience for a time, was the result. Happily, however, the latest reports show that the men have returned to work, on the promise of the Government to call a special session of Parliament to deal with the matter.

A Kent Coal Test.

It is many years now since hopes were first raised of the revolution which was to be caused in the South of England, from an industrial point of view, by the opening-up of coal mines in Kent. Early promises, however, have been extraordinarily slow in fulfilment; and long ere this many people have lost much besides hope in the enterprise. But of late the progress made towards the realization of early anticipations has been more marked, though past disappointments have naturally created a scepticism in various quarters which it will take something very tangible in the way of results to entirely dispel. Difficulties have been encountered in sinking operations, and there have been other troubles; but in spite of all the work has been persevered with, and a successful issue will bring great credit to those who have refused to be discouraged in their endeavours to open-up a new coalfield in this part of the country. All that a plentiful supply of coal in Kent would mean has been pictured many times before, and need not be repeated now. It has been dealt with by railway chairmen, and by those interested in the coal-mining companies; but now—and this is the point to which we wish to draw attention—it has been referred to by the chairman of a gas company, in his speech to the shareholders. It seems that the Directors of the Dover Gas Company have arranged to test at their works coal from the Snowdown Colliery; and should the results prove satisfactory, it is anticipated that the Company may at no distant date be able to obtain their supply from the neighbouring collieries. The suitability of Kentish coal for gas-making purposes was some time ago reported upon favourably, after some analyses had been carried out.

An Improved Gas-Washer.—Mr. P. G. Schmidt, of Olympia, Washington, has taken out a patent in the United States for a gas-washer. An abstract of the specification in the "Journal of the Society of Chemical Industry," says the appliance comprises a horizontal cylindrical casing, divided into inlet and outlet compartments by a central ring-shaped partition; the inlet and discharge orifices being in the periphery of the casing. A rapidly rotating member is mounted on a horizontal shaft within the casing, and this member has a central ring-shaped partition in the plane of the partition in the casing. The inlet compartment of the rotating member comprises a cylindrical screen through which all the gas passes towards the centre, in opposition to the centrifugal action of the rotating member; while the scrubbing liquid is introduced within the screen in the form of spray. A casing having an inlet and an outlet for the gas at opposite ends contains a rotating member comprising a set of concentric screens on each side of a central partition and radial blades on the outside of each set of screens.

PERSONAL.

Mr. PERCY DREWETT, who has for the last fourteen years been engaged at the Winchester Gas and Water Works, has been appointed Manager of the Fareham Gas-Works in succession to Mr. John Griffen.

In the notice of the death of Mr. ROSCOE WOODWARD in last week's issue, it should have been stated that he was brother of Mr. W. Woodward, of Bromley, and cousin of Mr. William W. Woodward, of Salford.

The Directors of the Drighlington and Gildersome Gas Company have appointed Mr. F. SCHOLEFIELD as Manager of their works. He was previously Assistant Gas Manager to the Dewsbury Corporation, and is a Past-President of the Yorkshire Junior Gas Association.

We are pleased to learn that Mr. CHARLES MEIKLEJOHN, the Engineer and Manager of the Rugby Gas Company, has been successful in his candidature for a seat on the County Council. At the election last Wednesday, he polled 262 votes more than his opponent, or more than two votes to one.

Mr. E. A. LEASK, who was recently appointed, out of more than 90 applicants, Assistant Superintendent in the Gas Mains and Distribution Department of the Leeds Corporation, took up his new duties on the 3rd inst. He carries with him the congratulations and good wishes of his old colleagues at Sunderland.

At a meeting of the Forfar Town Council last Tuesday, Mr. THOMAS HARPER, Works Engineer at the Dundee Gas-Works, was appointed Gas Manager to the Forfar Corporation in succession to Mr. James Dickson, who has been appointed to Johnstone. Mr. Harper is a native of Midlothian, and has had a long, varied, and valuable experience as an engineer. He began his working life in the service of the Lothian Coal Company at Newbattle, and afterwards was engaged by Sir William Arrol and Co. at Glasgow, acting as Superintendent of the gas manufacturing plant introduced into Edinburgh, London, Hove, and Dundee. About eleven years ago, he was appointed Works Engineer of the Dundee Gas-Works, and in this capacity superintended the whole of the work involved in the reconstruction of the gas undertaking.

OBITUARY.

JOHN RICHARD LEONARD CRIDLAND.

IT is with much regret that we announce the death of Mr. J. R. L. Cridland, the General Manager of the Danish Gas Company, which took place last Wednesday, after a short illness. The deceased gentleman, who was in his seventy-sixth year, went to Denmark in 1869 to take the position which he filled at the time of his death; thus representing the Company for a period of forty-four years. It will be in the recollection of many of our readers that, on the occasion of the visit of the members of the first Institution of Gas Engineers to Denmark in September, 1899, during the presidency of Mr. F. D. Marshall, who was then the Company's Engineer, Mr. Cridland's cordial co-operation with his colleague in making the visit a success was conspicuous throughout. In noticing the matter at the time, we said it would be difficult to speak in adequate terms of acknowledgment and gratitude for the reception accorded to the visitors, not only by the Directors of the Company and their local representatives, but also by the dignitaries of Copenhagen. Indeed, thorough good-heartedness was evinced by everybody who had any share, however small, in the arrangements. Mr. Cridland was greatly esteemed by all who were connected with the Company. He was well known in Copenhagen, and was a Knight of the Danneborg. He leaves a widow and a family.

Mr. F. D. MARSHALL writes of the deceased gentleman, the following

Appreciation.

"Never had a Company a more devoted and disinterested servant, never a more upright and righteous man. When almost a lad, I was called upon to fulfil the onerous duties of Chief Engineer to a Company far away from home. I can never forget the kindly and fatherly welcome with which I was received by a man, a stranger to me; nor can I ever forget the (almost) twenty-three years of the affectionate accord in which we worked together, and this with never a difference of opinion as far as the Company's interests were concerned—let alone a wry word.

"And this is a rare thing to say, when so many occasions arose on which the executive staff and the technical could easily have differed.

"To deal with concessions in ten different towns, with ten Burgomasters and ten cantankerous Town Councils, all in the interests of an alien Company, required tact, good temper, and a business ability accorded to few. But these attributes my friend and colleague possessed beyond most men.

"By the death of Mr. Cridland the Danish Gas Company have lost a devoted servant, and I a cherished and loyal friend.

"Tempted as he was by family influences and others to renounce his nationality, he died as he lived a clean and broad-minded Englishman."

F. D. MARSHALL.

ELECTRICITY SUPPLY MEMORANDA.

THERE are men in the electricity supply industry who dream dreams, and see visions. They dream, among other things, that the universal light is with us to-day; and that they have it in the eye-injuring, expensive to instal and to run (light for light) metallic filament lamp.

Dreaming.

Let them go on dreaming while the high-pressure gas-lamp is being installed, and the low-pressure inverted gas-lamp is gaining in favour. The more they encourage the idea that all is well, the more they will let things take their course in this line of business. While one thing is publicly said, another thing is privately felt by many central station engineers. It is that in numerous districts saturation point in electric lighting has been about reached under present circumstances, and that business must be sought in other directions with low-priced energy. Central station engineers would be very pleased to see more business done in the heavy-priced units. But they do not see much chance of making any further considerable advance in displacing gas lighting; and they will have greater trouble still if gas undertakings will only set to, and cultivate the maintenance of the highest gas-burner efficiencies. One electrician who shares the view that the lighting question is now settled in favour of electricity is Mr. T. P. Wilmhurst, who was reading a paper the other week before the Birmingham Section of the Institution of Electrical Engineers. The paper, however, only touched incidentally on lighting; the main purpose being to give expression to the author's views on the subject of cooking and heating.

The Empire of the Electric Cooker.

Mr. Wilmhurst is strong on cooking; and he is enthusiastic and confident. More than thirty householders have tried electric cooking outfits in Derby, and have comforted the Electrical Engineer with the information that they are satisfied with them. Mr. Wilmhurst neglected to say, according to the abstract of the paper before us, whether the whole thirty electricity consumers (or whatever number is the correct one) in Derby have complete outfits to-day; and whether they employ them exclusively. The latest returns of the Derby Gas Company show some 17,500 cookers in use; so that the Corporation Electricity Department has not made a large gap in the cooker connections of the Company. An interpolated remark of the author of the paper was that "it is no exaggeration to say that considerably more than half the revenue of the modern gas undertaking is derived from cooking." We say distinctly that it is an exaggeration to say this. Gas lighting, heating, and power, and industrial uses, and residual products, all contribute largely to revenue. However, such part of the revenue as electricians believe to be due to gas cooking is simply going, according to the fervent ones, to be diverted from the coffers of gas undertakings into those of the electricity industry. Electricians have only to say it; and it will be done. It matters not that the cooker outfit, installation, and utensils all cost much more than in the case of the gas-cooker; it matters not that the electric cooker contains so many convenient seats for mishaps; it matters not that in all boiling operations the electrical method is the one *par excellence* for sluggishness and expensiveness. These things are all of no account; electricity will be more economical than gas if (so Mr. Wilmhurst says) it is supplied for cooking at ¾d. or ½d. per unit—gas still being sold for the purpose at lighting rates, and not at prices, as in the case of electricity, 200 to 500 per cent. lower. It cheers some of our electrical friends to let these light fancies dance about where more serious thoughts ought to dwell. Among other flights of imagination on the part of Mr. Wilmhurst was this, that during cooking operations in a gas-oven the meat reposes in an atmosphere of "objectionable" products of combustion. We should much like Mr. Wilmhurst to be a little more precise as to the nature of these "objectionable" products, as we are rather inclined to think that he does not know what he is talking about in this regard. We should also be pleased to know what mysterious process goes on that causes electric heat to impart a better flavour to meat than any other form of heat. A few of the wideawake ones in the electrical industry begin to see the danger of public ridicule if the electric cooking champions continue to allow themselves to be the victims of delusions, and do not curb their silly talk.

The Shrinkage Nonsense.

There is, for example, the absurd idea that has gained currency among electrical people that the evaporation of water in the case of meat cooked in gas-ovens is uncontrollable, and that it is controllable in the case of meat cooked in the electric-oven. In point of fact, the claims have risen to such an extent respecting this saving of water through the electric-oven that there ought to be a reduction of the water-rate in all houses where the electric-cooker is installed; for those who eat the electrically cooked meat cannot require nearly so much water to assuage their thirst as those who eat (accepting for the nonce the views of some electrical journalists and platform orators) the parchment-like meat that escapes from the gas-oven. There ought also to be a saving in the alcoholic drinks usually consumed during dinner and luncheon; but some of our electrical

friends would never forego the use of the gas-oven if this were to be a result of the change-over to the electric-oven. However, the "Electrician" is getting tired of the absurdity of the electric-cooker boosters regarding this point of meat shrinkage, and prefer that the business should be cultivated on sound lines, rather than that cheap-jack methods should form part of the developing agency. Our contemporary writes: "In placing the advantages of electric cooking before the public, we must confess that in future we should like to see less insistence placed on the question of the loss of weight, which, after all, is, to a considerable extent, dependent on the skill of the cook, and to a less degree than is sometimes supposed upon the type of apparatus used." We are pleased to see this frank avowal of the feeling that there has been a great display of electrical folly over this question, more especially after the point-blank refusal there has been from the electrical side to have a public competition. We notice that Miss Padley, who is the cooking expert of an Electricity Supply Company, subscribes to the nonsense that has been uttered; but this lady, if she has been reported correctly, carefully frames her statement. The occasion of her remarks was a conference, held under the auspices of the National Training School of Cookery, at the Royal Sanitary Institute, Buckingham Palace Road, last Saturday week. There was a discussion on the subject of Gas *versus* Electric Cooking. Miss Helen Edden, ot the Gaslight and Coke Company, championed gas; Miss Padley, electricity. The report before us states that the latter lady said "that, with the electric-cooker, the shrinkage of meat *need not* be more than 7½ to 10 per cent.; whereas 25 per cent. was usually *estimated* when 'other forms of heat' [*sic*] were employed." There was care exercised in the phrasing of the statement. The "need-not-be-more" shrinkage with the electric-oven is the "need-not-be-more" shrinkage with the gas-oven; what is "estimated" for the gas-oven can also be "estimated" for the electric-oven. The cook is the real governor of the situation. At the conference referred to, we see that a vote was taken, and that 22 hands were held up in favour of gas cooking, and 34 in favour of electric cooking. Perhaps Miss Padley had taken steps to see that she was not left on the occasion in an isolated position. The report states that the majority of those present refused to vote one way or the other, as they had had no experience of electric cooking, and so very properly felt that they were not in a position to express an opinion. From this, it may be surmised that those who did vote for electricity, or the major part of them, earn their daily bread by attempting to push the interests of the electric-cooker; and we venture the opinion that there are few of them who have electric-cookers in their own homes, but rely there fully and thankfully upon the faithful, simple, and economical gas-cooker.

Wonderfully and Fearfully Made.

A short time since Mr. A. H. Seabrook, official chief of the Marylebone Electricity Department, was wroth—very and justly wroth—that the makers of electric-cookers did not include a plentiful supply of fuses in the construction of their apparatus—the result of the deficiency being that the blowing of one fuse rendered the cooker and all its functional parts *hors de combat*. The fitting of a fuse to the supply wire of each element, said our sagacious friend, was the proper thing; and the cost of an outfit would only be increased by (say) 30s. to 40s. by this protection against the unreliability of the whole equipment. We learn from a trial-user of an outfit that a dinner has been completely spoilt by what happened when a fuse went in connection with one of the oven heating elements—the heating of the oven (consequently the cooking) was a sort of one-sided affair, until an expert came along, and remedied the state of things. However, the multi-fuse cooker is a more costly thing than the mono-fuse cooker. In the cooking and heating notes in the "Electrical Times," there is now another suggestion which adds to the cost of an outfit. We will give an extract from the statement: "Makers of electric ovens and cooking outfits are realizing that it is a mistake to mount switches and fuses on the apparatus itself. Apart from trouble from overheating, and risk of short-circuit through the spilling of water and grease, it is inconvenient to the user to have switches in all sorts of positions on a range—some at the bottom, where they cannot be got at comfortably, and are liable to mechanical injury, and others below the hot-plate in front or at the side. If rotary switches be used at the foot of the oven, it is impossible to see what circuit is closed without bending double to read the indicator, and often it is difficult to see the indicators and switches at the side of a hot-plate. Since every circuit should have its own fuse as well as its switch, a large cooking range requires quite a switchboard; and if pilot lamps be added, the space needed is more than that for which most cookers have accommodation. In these circumstances, and without reference to technical considerations at all, it becomes imperative to group switches, fuses, and pilot lamps on a wall panel near the cooker, all circuit-wires being taken in barrel or flexible metallic tubing from the cooker to the board—the armouring forming a ready means for earthing the cooker and control board. It is true that the provision of a control panel adds *appreciably to the initial cost* of the outfit; but the gain in convenience, appearance, and reliability more than compensates for this. The use of a pilot lamp, or similar device to give optical warning that a circuit is closed is advisable in every case, and tends to reduce waste. A lamp, provided its filament is unbroken, will also indicate whether any circuit is faulty, and directs attention to the need either for replacing the fuse, or for examining the heating unit itself. What a lamp does not do, however, is to indicate whether part of a circuit has broken down. It will continue to glow as long as any single unit forming part of the oven circuit, for example, remains intact, and the cook only discovers a breakdown through failure of the oven to do its work properly." It is easy to understand the fervent manner in which an electric cookery teacher and demonstrator returned thanks for the divine decree that the "labour" of the week should be limited to six days. We are also getting to know more and more that the testimonials of electrical expert cooks cannot be taken as representing the consumptions and waste that obtain (without their presence) in the few ordinary households in which electric cookers have been installed. We are likewise getting to learn more and more why it is that people who have adopted electric-ovens and so forth in Marylebone receive a visit from an expert every few days. Above all, there is something to be thankful for in the simplicity and constancy of the gas-cooker.

Pretender, or Unbeliever?

"Meteor" of the "Electrical Times" does not believe that the modern gas-fire gives in useful heat to a room 75 per cent. of the combustion heat of the fuel used; nor does he believe that the reports that emanated from the Leeds University ever said so. "Meteor" does not know much (if anything) about these reports. He recommends us to re-read them; we, in turn, recommend him to accept his own advice to us before he again writes on the subject. Referring to what is a somewhat prevalent and well-founded belief respecting the poorness of the heating capacity of the so-called electric "radiator," he remarks that "hearsay is good enough for small talk." Therein lies the secret of what he has to say regarding the efficiency of the modern types of gas-fires. The work at the Leeds University extended—not over a few hours, but over some years; and several reports were made upon the subject. If "Meteor" will read the report for 1909, he will see the thorough manner in which the research was conducted, by the Research Chemist, Mr. E. W. Smith, M.Sc. In the 1910 report (the gas-fires tested being of the 1909 type) will be found the results of a large number of tests; and to take a sample line: Radiated heat, 42·85 per cent.; convected heat, 37·15 per cent.; flue heat, 20 per cent. The highest radiant efficiency that year was upwards of 48 per cent. The research work at the Leeds University, and that in the laboratories of the gas-fire makers has resulted in structural improvements whereby the radiant efficiency has been increased; and Mr. Smith has since publicly stated that the new types of fires give upwards of 50 per cent. radiant efficiency. We suggest to "Meteor" that he should now study the documents; they are open to all. We should also like him to inform us whether his own tests were carried out with the scientific accuracy and instruments as applied to the Leeds University research. If not, why commit the folly of writing in such a dogmatic strain as is found in the sentence: "The efficiency of the average gas-fire in heat given off usefully in the room is below 20 per cent. of the theoretical heat units in the fuel." We ask "Meteor" to produce the average gas-fire of current make with an efficiency as low as 20 per cent.

Gas Companies and Electricity Supply.

There is a little mystery about the attitude of some electrical people. The North Metropolitan Electric Power Distribution Company have robed themselves in the garments of altruism. They have done their level-best at trying to prevent the local authorities supporting the application of the Tottenham and Edmonton Gas Company for electricity supply powers in Wood Green, where three of the best possible customers for electricity are already being supplied with gas-generated electrical energy. The failure of the Power Company to get much local sympathy, and their terms not being so good as the Gas Company could offer, they have adopted a new *rôle*. They are pleading for the support of other Borough Councils on the ground that, having regard to the increase in the price of gas that "may" result from the supply of gas and electricity being combined, the Councils should oppose the scheme. The Hornsey Council had a letter to this effect; and the Council refused to adopt the suggestion. So far as we have seen, there is an omission in the North Metropolitan Company's communication. They do not explain in what way the scheme is likely to cause an increase in the price of gas, nor do they state why they are displaying such solicitude in wishing to prevent the Gas Company taking a step that will increase the price of gas, which ought to be to the advantage of the Electric Power Company in all the parts of the gas-supply area in which they are trading in electrical energy. There is something a little anomalous between the position of the Electrical Company and the reason they advance for opposition by Borough Councils.

Southern District Association of Gas Engineers and Managers.—The annual general meeting of this Association will be held at the Hotel Cecil, Strand, on Thursday, under the presidency of Mr. H. O. Carr, the Engineer of the Wandsworth, Wimbledon, and Epsom Gas Company. According to the programme issued by the Hon. Secretary (Mr. W. E. Price, of Hampton Wick), the business will consist of the presentation of the report of the Committee, the election of new members and of a representative on the Council of the Institution of Gas Engineers, and the delivery of the President's Address. The members later on dine together.

BRITISH COMMERCIAL GAS ASSOCIATION.

Report of the Executive Committee.

On Tuesday last there was a meeting of the General Committee of the British Commercial Gas Association when the Executive Committee presented a report, from which the following paragraphs are extracted.

Honour to the President.

The Executive Committee at their meeting in January passed a resolution conveying to the President the pleasure with which the members of the Association had observed the well-deserved honour bestowed upon him by the King.

Additional Subscribers.

Special steps have been taken to bring the claims of the Association before all non-subscribing undertakings with an annual make of 4 million cubic feet and upwards, with very satisfactory results. Since the last meeting of the General Committee, the following undertakings have been added to the list of subscribers.

Alloa	Longwood
Ashton-under-Lyne	Matlock
Banbury	Monte Video
Belfast	Newport (Mon.)
Bewdley	Portsmouth
Calverley and Horsforth	Queenstown
Cinderford	Riddings District
Cockermouth	Rochdale
Crewkerne	Rossendale
Denbigh	Rushden and Higham Ferrers
Dewsbury	St. Blaxey
Draycott	Saltash
Dunfermline	Seaham Harbour
Edinburgh	Seascale
Gillingham	Sherborne
Grange-over-Sands and Cartmel	Shirebrook
Great Wigston	Southwell
Hoddesdon	Staines and Egham
Holywood	Sturminster Newton (Devon Gas Association)
Huddersfield	Sutton
Hythe and Sandgate	Tawe Valley
Jersey	Tuxford
Kincardine-on-Forth	Vale of Leven
Knottingley	Wells
Leeds	Whitworth Vale
Leicester	

This represents an addition to the annual income of the Association of £1022. This sum, it is hoped, will be increased in future years, as some of the larger undertakings included in the foregoing list have only agreed to give partial support at the present time. In view of the fact that those who began by giving partial support have, in many cases, subsequently become full subscribers, the Committee feel confident the same will prove to be the case with those whose names have recently been added to the list.

Special Contributions to the Funds of the Association.

In addition to the numerous gas undertakings added to the list of subscribers as enumerated above, the Executive have special pleasure in reporting the receipt of subscriptions of five guineas each from the Manchester Institution of Gas Engineers and from the Lancashire Commercial Section affiliated with that District Institution respectively. These very practical evidences of belief on the part of the members of the Institution and Commercial Section in question, in the value of the work which is being done by the Association for the industry as a whole, will undoubtedly be much appreciated by all members of the Association. It should be added that the District Associations and Commercial Sections generally are co-operating heartily with the Executive in the endeavour to secure the full support of all gas undertakings throughout the country.

Representation of Districts on the General Committee.

The additional subscriptions received or promised during the current financial year have entitled the following districts to additional representation on the General Committee, in accordance with Rule 7E—namely, Manchester District, Midland District, Scotland, Southern District, and South-Western District. Mr. Hubert Pooley, of Leicester, has been elected the additional representative for the Midland District, and Mr. Robert Beynon, of Torquay, has been elected by the South-Western District as their additional representative. Steps are being taken to arrange for the election of additional representatives for the other districts.

International Committee on Commercial Advancement in the Gas Industry.

The members will have noted as an indication of the activity of the commercial gas men in America that, on the initiative of the President of the National Commercial Gas Association, an "International Committee on Commercial Advancement in the Gas Industry" has been formed; and that the gas industry in this country has not only been invited to co-operate but has been chosen to provide the first Chairman of the Committee, in the person of the Chairman of the Executive of this Association. At least one representative of the American Association (Mr. O. H. Fogg) will be present at the Second Annual Conference of the British Association, which it has been decided to hold on the 21st and 22nd of October next, in the buildings of the National Gas Exhibition, Shepherd's Bush.

Advertising Campaign.

The additional financial support which is now assured to the Association has enabled the Executive to arrange for some extension of the advertising campaign during the current year, both by way of adding to the list of newspaper publications in which the Association's advertisements appear, and also by way of increasing the space taken in some of the publications already on their list. The current month will see a big extension of advertising as compared with the past two or three months, as it is the approved policy of the Association to concentrate its publicity work upon those seasons of the year when advertising is most likely to be effective for the industry. During the present and ensuing month, the advertisements will be concentrated largely upon cooking and hot water supplies; while in the autumn gas-fires and gas-lighting will be the principal subjects of the campaign.

Lady Demonstrator.

Arrangements are being made to secure the services of an expert Lady Demonstrator and Cookery Lecturer, who will be available for service among subscribers in various parts of the country. She will be an official of the Association; and her services will be charged to subscribing undertakings at an inclusive weekly rate.

Production and Sale of Literature.

The list of booklets, posters, post-cards, and other advertising matter continues to increase. Subscribers in all parts of the country are gradually realizing more fully the excellent service that is now at their disposal in this connection; and orders are constantly being received for considerable quantities of literature. The total sales to date amount to 1,303,450 items of advertising matter.

Inquiries Resulting from Advertisements.

The Association's advertisements continue to attract considerable attention. Inquiries are continually being received; and evidence is steadily forthcoming that business results from many of the inquiries.

(Signed) F. W. Goodenough, Chairman.

WATER LEGISLATION FOR 1913.

[Fourth Article—Provisional Orders.]

In preceding numbers of the "Journal," the Bills promoted by companies and local authorities to obtain powers in regard to water supply were noticed. We now deal with the applications for Provisional Orders.

The Alresford Water Company are applying for authority to maintain and continue water-works, and supply water in certain parishes in the county of Southampton. The existing works consist of a well and pumping-station, tank, and reservoir in the parish of New Alresford; and the Company seek power to make subsidiary works and take water. The rates to be charged for domestic supplies range from 8s. 8d. per annum where the gross estimated rental of the premises does not exceed £5; and from 10 down to 8 per cent. for various rentals above this. For every closet beyond the first, the Company ask to be allowed to charge not exceeding 10s. per annum; and for every fixed bath containing not more than 50 gallons, not exceeding 15s. The price of water supplied by meter is not to be more than 2s. 3d. per 1000 gallons. The Company request power to sell water in bulk, to sell or let meters, and to supply fittings. The share capital is not to exceed £27,000, comprising the original capital of £7000 (£3500 preference and a like amount of ordinary); and additional capital, to be issued subject to the provisions of the Order, not exceeding £20,000, including premiums. The dividends are limited to 10 and 5 per cent. upon the original ordinary and preference capital, and 7 and 5 per cent. upon the additional capital. The borrowing powers of the Company are not to exceed one-third of the paid-up capital; and the interest paid thereon must not be more than 5 per cent., unless a higher rate is sanctioned by the Board of Trade. The new capital is, of course, to be sold by auction or tender. [*Parliamentary Agents: Messrs. Martin and Co.*]

The Mexborough and District Water Company, Limited, require power to raise additional capital not exceeding £10,000; and the nominal amount of the capital of the undertaking is not to be more than £20,000. The dividend on the new capital, which is to be sold by auction or tender, is not to be higher than 7 per cent. on the ordinary or 5 per cent. on the preference. Borrowing powers to the extent of one-third of the original and

additional capital are required. The Company wish for authority to hold lands for the protection of their works, and to erect cottages for the officers and servants. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

Authority to extend their limits of supply is applied for by the Borough of Portsmouth Water Company. Should the Order be granted, the parish of Portchester, in the rural district of Fareham, in the county of Southampton, will come under the provisions of the various Acts and Orders of the Company. The provisions of the Order are of the usual character. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Topsham and District Water Company, Limited, are seeking authority to maintain and continue water-works, and supply water in the parishes of Topsham, Clyst St. George, Woodbury, and Lympstone, in the county of Devon. The works consist of a well and pumping-station in the parish of Topsham; and the Company require power to make subsidiary works and take and impound waters. The capital is not to exceed £9000, comprising the original capital of £735 and additional capital to the amount of £8265; and the dividends are limited to 10 per cent. upon the former, and 7 and 5 per cent. upon the latter. The amount borrowed is not to exceed one-third of the paid-up capital. The Company require powers to use and acquire lands and easements, erect cottages for officers and servants, and make bye-laws for the prevention of waste. The Order contains provisions for supplying water in bulk, selling or letting meters, &c. [*Parliamentary Agents: Messrs. Batten, Proffitt, and Scott.*]

Application is being made by the Wey Valley Water Company for power to construct new works and raise additional capital. The works consist of a well or wells and a pumping-station in the parish of Frensham, in the county of Surrey; and the amount of new capital specified is not to exceed £40,000, with power to borrow to the extent of one-fourth and create debenture stock. The new stock is to be sold by auction or tender; and the dividends are limited to 7 and 5 per cent. The Order contains the usual provisions as to the supply of water in bulk, the sale or supply of fittings, &c. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The following applications have been made to the Scottish Office under the Private Legislation Procedure (Scotland) Act.

Power is being sought by the Dunfermline District Committee of the County Council of Fife to construct additional water-works, consisting of a reservoir in the county of Perth, another in the county of Fife, and an embankment, two aqueducts, and an access road in the former county. Seven years are required for the completion of the works. The Committee ask for authority to enter into agreements with other local bodies for the supply of water in bulk and for other purposes; also to extend, amend, or repeal agreements entered into between them and the Corporation of Inverkeithing. Provision is made for affording a supply of water to the naval establishment at Rosyth. The Council require authority to borrow the following amounts: £9550 for the purchase of lands and servitudes; £99,000 for the reservoir and the embankment in Perthshire; £4400 for the reservoir in Fife; £3300 for the access road; and £1050 for subsidiary works. These moneys are to be repaid within periods ranging from sixty down to thirty years. [*Parliamentary Agent: Mr. J. Kennedy.*]

The Water-Works Commissioners of Kirkcaldy and Dysart require authority to extend and improve their water-works, and construct and maintain others, comprising enlargements of their Ballo, Holl, and Arnot reservoirs, four aqueducts, and filters near the existing filter-house beside the embankment of the Holl reservoir. Provision will be made for the prevention of the pollution and waste of water, and of interference with mains and other works. The Commissioners require power to apply for the purposes of the Order any moneys already authorized to be borrowed, and also to raise additional money for the purposes of their undertaking. [*Solicitors for the Order: Messrs. Beveridge and Aitken.*]

Application will be made by the District Committee of the Middle Ward of the county of Lanark for power to construct additional works, consisting of a storage reservoir, a service reservoir, and a number of aqueducts and road diversions. It is proposed to abandon the Glengavel reservoir; and the Committee will ask for a reduction of the compensation water and for a release from other obligations relating to the reservoir. Authority will be sought for an extension of the water limits, and for the repeal of the power of other authorities to supply within the added area. Domestic supply is to be defined; and the provisions of Water Acts relating to the domestic water-rate are to be repealed or amended. The Committee require authority to carry out schemes of afforestation, and to raise more money for the general purposes of the Order. [*Parliamentary Agents: Messrs. Grahames, Currey, and Spens.*]

The Corporation of St. Andrews are applying for confirmation for the construction of a conduit or pipe-line, permission to abandon certain authorized works, and power to raise more capital. The conduit or pipe-line just referred to is situated wholly in the parish of Cameron and the county of Fife; and the works which it is proposed to abandon are a water-tank, a conduit, and a specified portion of another. Compensation is to be made in respect of these works. The limits of compulsory supply are to be extended as set out in a schedule to the Order. Authority is sought for the borrowing of £15,000 for water-works purposes, to be repaid within fifty years. [*Parliamentary Agents: Messrs. Beveridge, Greig, and Co.*]

THE LIGHTING OF A WORKHOUSE.

An Experience at Slough, and the Use Made of Figures having Incomparable Bases.

"With the Secretary's compliments," a booklet reaches us from the Slough and Datchet Electric Supply Company, Limited. It is composed of a reprint of a report, taken from the "Windsor and Eton Express," of a statement made at a meeting of the Eton Board of Guardians regarding the "saving" that there has been through the electric lighting of the Slough Workhouse, compared with the cost of gas used for lighting, cooking, greenhouse, and other heating. The statement is one of the most unfair that could be employed for advertising purposes; and if the Slough Electric Supply Company are circulating it for the purpose, we should say that the proceeding was not honest, in that it does not represent what gas can do to-day for the consumer in comparison with what electricity can do. There is nothing whatever about the conditions anterior to, and during, the electric lighting of the workhouse that are comparable. Here we have new electric filament lamps on the one side; on the gas side 186 flat-flame gas-burners and only 22 incandescent ones, not representing the modern types, and the cost figures are all mixed up with cooking and heating. We find that there were in use one large double hot-plate and one large cooking-stove, five boiling-rings (one being placed in a slow combustion stove in the men's ward), and there was the greenhouse heating. There were also three points for connecting rubber tubing. We say emphatically that it is an outrage on honesty to give circulation for comparative purposes to such figures. If the consumptions for lighting, cooking, heating, and greenhouse use had been separately metered, there might, with proper explanation as to the types of gas-burners used, have been a fairer fundamental basis to work upon.

The comparison as published is as follows:—

GAS.

	£	s.	d.
Gas for light, cooking, and rent of stove	200	16	0
Repairs, mantles, burners, &c.	6	14	9
Coal, 20½ tons at £1 per ton	20	10	0
	£228	0	9

ELECTRIC.

	£	s.	d.
Electric current and rent of meters	£47	2	6
Lamps for renewals	3	0	0
Coal, 10½ tons at £1 per ton	10	5	0
One-tenth cost of new range and fixing (£31 1s. 6d.)	3	0	0
One-tenth cost of installation (£150)	15	0	0
	£78	7	6

	£	s.	d.
Gas	228	0	9
Electric	78	7	6
Total saving	£149	13	3

It should be explained that there were at one time in use an old coal kitchener in addition to the gas hot-plate and the gas-cooker. The old coal kitchener and the gas-stoves have been replaced by a new coal range. It seems to us from the figures available that there has been a magnificent sort of waste going on at the workhouse through the use. and increasing use, of old-fashioned appliances, probably (we do not say that it was in this case) supplemented by the want of interest that is oftentimes found in the staffs of public institutions, and which does not result in economy.

In the year 1908, the consumption of gas was 558,000 cubic feet; in 1909, 774,800 cubic feet; in 1910, 951,000 cubic feet; and in 1911, 1,077,700 cubic feet. Taking the consumption of 1908, and calculating on the price offered to the Guardians in 1911, it is found that the account would have worked out to £100 0s. 11d.—old flat-flame gas-burners, cooking, and heating all included!

Now if there had been any desire to be fair to gas lighting, the figures published would have been suppressed, unless care had been taken to have metered separately the gas used for lighting, and an account kept of the hours of use of the burners. It would also have been ascertained what were the relative photometrical values of the lights. But none of these particulars are given. It would have been fairer to gas lighting, if the lighting power, and consumptions of some modern inverted burners had been ascertained by experiment in comparison with the metallic filament lamps. Then the Guardians would have been able to see exactly whether, for lighting purposes, the greater saving would have been on the side of gas or on that of electricity. Nothing of the kind appears to have been done. As to the illuminating power, all that can be gathered is that, when Mr. Howlett (who appears to have taken the lead in this matter) interrogated the master of the workhouse at the meeting of the Guardians that worthy gentleman said the lighting was better now than when it was carried out by gas. We have heard of visual tests and impressions before now; and they do not always confirm the tale of the photometer. But knowing that 186 burners were of the flat-flame type, we are not surprised at the master's statement. The master also said, in answer to Mr. Howlett, that the atmosphere of the building had been improved. We should have preferred chemical tests to ascertain this, rather than the *ipse dixit* professions

of the master of the workhouse. Too much weight should not be placed upon replies to leading questions put in this way by a chairman or member of a committee to an officer under his control. We have yet to meet the public official who has not given the reply that the chairman or an influential member of his Committee desired to a personally put question. It is no doubt a fairly safe surmise that Mr. Howlett was satisfied before he put the questions in public as to the character of the replies that he would receive; but there is no proof as to the scientific accuracy of the answers. But whether the reply was right or whether it was wrong in relation to the illuminating power, it does not disclose what would have been the result with modern gas-burners pitted against metallic filament lamps. On the point as to the purity of the atmosphere, we see Dr. Meggs stated, at the meeting, that there was "no doubt" the air of the infirmary was much better now that electricity is used. It would be interesting to know on what grounds Dr. Meggs says this. Has he made any definite chemical experiments, and in what way does he think that the air of the wards was deteriorated by the gas lighting? Some medical authorities have found an improvement in the atmosphere of rooms by the air currents set up by the use of gas-burners, while they have also found (as in the case of gas, so in this, by experiment) that, unless there is mechanical ventilation where electric lighting is used, a stagnant condition of the atmosphere often results. Dr. Meggs most probably knows that a stagnant condition of the atmosphere is not a healthy one. There are oculists, too, who have found that the high intrinsic brilliancy and the ultra-violet rays of electric lamps are separately and both just as harmful to the eyes of elderly people as to children. Perhaps Dr. Meggs has never investigated these matters; if he has, we should much like to receive from him a description of the lines, and the results, of his investigation for comparison with statements in our possession from celebrated authorities.

However, these do not constitute the main question in this matter. The main question is one of lighting; and the comparison is altogether vitiated because all the elementary factors needful for proper comparison are not given. We do not notice in the report the price at which current is supplied to the workhouse; the character and the photometrically measured power of the old gas-burners; nor are we told the photometrically measured illuminating power of the metallic filament lamps; nor do we know the number of burners in the two periods that were in use, nor the hours of their use. There is nothing whatever in the way of a sound basis for comparison. We will make a suggestion to the Slough and Datchet Electric Supply Company, which would give them a better and more stable comparison upon which to work. It is that they should arrange with the Gas Company for a competitive test of (say) a modern 50-candle power inverted gas-lamp and a 50-candle power metallic filament lamp, and if they like, a 25-candle power lamp of each type—the test including photometrical measurement, consumption, and number of hours of use. The test of each lamp should continue until a supply of current and quantity of gas costing an equal price has been exhausted. Then the result of the test signed by both the Gas and the Electrical Engineer could be circulated as authentic throughout Slough. This would be much fairer (the people of Slough will recognize that it is so) than the publication of massed figures—the product of confused and incomparable conditions. Let us assume (the figure will be approximate enough for the purpose) that the ordinary private consumer in Slough pays 6d. per unit for electrical energy: A 50-candle power metallic filament lamp, taking 62 watt-hours, would cause the expenditure of a unit of electricity in 16 hours. Let us assume that 6d. will purchase in Slough 132 cubic feet of gas: A 50-candle power inverted gas-lamp, with an efficiency of 20 candles per cubic foot of gas, thus using 2½ cubic feet per hour, would run for about 52 hours on the 132 cubic feet of gas. Sixteen hours for electricity, and fifty-two for gas—cost for cost, and light for light! Now that is the actual position of things to-day—a position that can be proved by a test. Will the Electricity Company enter into a test of the kind? A test such as this, we say, would be more honest to circulate among the inhabitants of Slough than the figures that have emanated from the workhouse, which are vitiated through the omission of all factors that render comparison possible.

If the Electric Supply Company will not enter into a test of this kind, with the condition attached as to the certified results being circulated, then we should recommend the Gas Company to fit up and run in a show-room window a metallic filament lamp and a modern inverted gas-lamp, of equal candle power, with meters attached—making daily announcements in the window and weekly through the Press as to consumption and costs at local rates. We would take these measures as a reply to the use of such statements as this workhouse one. The same course has been taken with excellent effect in other places where the results of conditions that are not fairly comparable have been made use of by the electrical people with the view to capturing custom—a method that, to say the least, does not strike us as honourable.

VISIT OF GAS ENGINEERS TO THE ANTWERP EXHIBITION AND GAS-WORKS.

The Vertical Retorts at the Zurenborg Gas-Works.

TAKING advantage of the fact that the Antwerp Gas Exhibition —of which notices have appeared in the last two numbers of the "JOURNAL"—was being held at the time, Mr. A. F. P. Hayman, the Engineer and Manager of the Antwerp branch of the Imperial Continental Gas Association, issued invitations to the members of the Association des Gaziers Belges and a large number of his professional brethren to visit the city last week.

On Wednesday evening, Mr. Hayman's visitors began shortly before eight o'clock to assemble in the brilliantly gas-lighted grounds of the Salle d'Harmonie—where the exhibition is being held. Among the guests were: Lieut.-General Van Sprang, the Military Governor of the Province, M. Strauss, Alderman of the city, and MM. Dewinter, Lemeunier, and Lepaige, Engineers of the city. The delegates from abroad included Mr. H. F. Andresen, the Assistant Secretary of the Imperial Continental Gas Association, Mr. William Drory, Director of the Frankfurt Gas-Works, Mr. William Anderson, of Hanover, Mr. Edward Körting, of Berlin, Heer Bolsius and Heer Van Doesburgh, the President and Secretary of the Dutch Gas Association, Herr Lempelius, of the German Gas Association, Mr. H. H. Salomons, of Brussels, Mr. Brender à Brandis, of Antwerp, and M. Pavoux, President of the Belgian Gas Association.

Mr. Hayman opened the formal proceedings by thanking the guests for having come in such large numbers to see the exhibits, and for giving one more proof of their friendly feelings towards Belgian engineers. In an eloquent speech, M. Pavoux thanked the local authorities and the representatives of foreign States for their support, to which the undoubted success of the exhibition was largely due. He welcomed all his foreign colleagues, and remarked that the presence of so many distinguished members of the gas industry was the best proof that they could have of the interest evoked by the "Palace of Light" in which they were assembled, and which all must have greatly admired. He fully appreciated the good work of the Executive Committee, who had left nothing undone that might make for the complete success of the venture, and whose efforts had met with such entire appreciation. M. Pavoux said how much the whole of the gas industry owed to the initiator of the exhibition, Mr. Hayman—the mention of whose name evoked loud applause. Finally, he paid a tribute to the efforts of the Press, which had given such able support to the enterprise, and raised his glass to the continued success of the exhibition—already visited by more than 30,000 people.

Mr. Körting proposed the toast of "Prosperity to the City of Antwerp," and Heer Bolsius that of Heer Van Heede, the indefatigable Honorary Secretary of the Belgian Association—one of the most popular members of the gas profession in Holland.

Mr. Walter King, on being called upon, remarked how much England owed to the authorities at Antwerp for having organized such a brilliant demonstration of the capabilities of gas, in its many branches, for public lighting and domestic use.

Mr. H. Franken, the President of the Exhibition Executive, closed the toast list by remarking (only too modestly) that all the success attained was due far more to the ready support given by the exhibitors and all interested in the industry, than to those forming the Committee with whom he had had much pleasure in working.

After considerable time had been spent in viewing the exhibits, an enjoyable evening was brought to a close, while the orchestra rendered a selection of National Anthems.

VISIT TO THE ZURENBORG GAS-WORKS.

On Thursday morning, an early start was made by special trams for the Zurenborg Gas-Works, at Berchem; and the guests of the previous evening were reinforced by a number of members of the Belgian Association who were unable to reach Antwerp the previous day. The visitors were received by Mr. Hayman and conducted round the works by the Engineers, MM. Devigne and Bousin. On pp. 663-6 of to-day's issue a description of the station is given—translated from an illustrated brochure, a copy of which was handed to each guest. After the inspection, light refreshments were served, and then a move was made to the Zoological Gardens.

LUNCHEON.

This was served in the splendidly appointed marble hall, and was in every respect a sumptuous repast. The guests of the Compagnie du Gaz d'Anvers numbered about 150. Mr. Hayman presided, and was supported by a number of very distinguished people. The vice-chairs were occupied by MM. Devigne, Bousin, Steinkühler, Ditte, and Gandon. At the close of the banquet,

The toast list was opened by Mr. Hayman, with the "Health of the King and Queen of the Belgians," and similar honours to the rulers of the countries represented at the tables. Sir Cecil Hertslet (the British Consul) replied. Some complimentary references to the services rendered by Mr. Hayman and the Gas Company, in providing for the comfort of the inhabitants of the

city, were made by General Van Sprang and M. Strauss; and these were followed by what was the chief speech of the afternoon.

Mr. Brender à Brandis said he had been requested, in the name of the Imperial Continental Gas Association, to welcome all the gas engineers from at home and abroad who were present at the banquet. It afforded them much pleasure that so great a number of their colleagues and friends had been able to accept the invitation; and they regarded it as a great honour to see present so many distinguished representatives of the gas industry of Belgium, Great Britain, France, Germany, and Holland. Great Britain, of course, must be regarded as the country where the gas industry had its birth—seeing that it was in England that Murdoch and Clayton were undoubtedly the pioneers; being followed by Clegg, who designed the first gas appliances, which were subsequently introduced all over the world, and which in principle were still in existence in most modern works. France—a country always at the head of progress and civilization—might well be proud of the names of Philippe Lebon and Regnault—men who by their scientific labours contributed so much to the popularization and rapid development of gas. Germany—ever powerful through the excellent education given to its sons—seemed at present to occupy the most important place in the development of the gas industry. Her modern systems of gas-making in vertical retorts had been introduced all over the world. Belgium and Holland, though smaller countries compared with their mighty neighbours, but with an intelligent and energetic population, were also proud to include the name of Minckelers in the early history of gas lighting. It was he who first discovered the useful qualities of coal gas, and was able to make such practical use of it. In modern times, there was M. de Brouwer—"the famous and modest inventor who caused a real revolution in the gas industry; his name is the glory of the Belgian gas industry." Continuing, Mr. Brender à Brandis said he rejoiced that in the gas industry it was not necessary to send out professional spies in order to find out what improvements were being carried out by various neighbours. A duly accredited gas engineer was always sure to be received in a friendly and cordial spirit by his colleagues, and would find the gates of every gas-works open for his study and investigation of all processes carried on within. This great advantage for the industry was not only due to the good feeling existing between gas engineers as individuals, but to a large extent to the existence in all civilized countries of Technical Associations, where matters of interest were studied and discussed by technical and scientific men. "*L'Union fait la Force*" was the Belgian national motto; and it had taught them to strengthen the excellent relations existing between all Technical Associations throughout the world. He concluded by proposing: "Prosperity to the British Institution of Gas Engineers, the health of Sir Corbet Woodall, the President of the Institution and the Governor of the Gaslight and Coke Company, the oldest and mightiest Gas Company of the world, the centenary of which was celebrated in 1912." "The health of Mr. Charles Carpenter, the Chairman of the South Metropolitan Gas Company, the eminent gas engineer who took up the mantle of the much regretted Sir George Livesey." "The prosperity of the Société Technique de l'Industrie du Gaz en France, and the health of M. Laurain, representing there that Society, and himself a Consulting Gas Engineer of eminence in Paris." "Prosperity to the German Gas and Water Association." "The health of Mr. William Drory, a member of the Committee of the German Association, and the 'doyen' of the gas industry, who for sixty years has devoted himself body and soul, and with an energy beyond all praise, to our industry." "The health of Mr. Körting, the ex-President of the German Association, and Engineer of the Imperial Continental Gas Association at their works in Berlin. To several of them he was no stranger, because, in admiring the model installation of the Mariendorf works, they had been able to appreciate the great personal qualities of their colleague." And, finally, they must remember Herr Lempelius, the Director of the Central für Gasverwertung; the Belgian Association of Gas Engineers; and its President, M. Pavoux, who were honouring them with their presence at the table. And last their best wishes must go forth for the recovery of their colleague M. de Brouwer, who was prevented by serious illness from witnessing their high esteem and admiration for him. And there were also M. Aerts, Mr. Salomons, and M. Franken who should be named.

Acknowledgments followed from Mr. Drory, M. Laurain, Mr. Salomons, Heer Bolsius, and Mr. Walter King; and after coffee had been served in an adjoining salon, the party broke up, and a number of the guests went again to the Exhibition, where M. George Steinkühler gave an interesting lecture, with detailed explanations of the novelties shown. This portion of the proceedings was much appreciated, and duly acknowledged.

The proceedings closed with a tea given by the Organizing Committee, in whose name M. Franken again thanked the foreign visitors for supporting them in such great numbers.

The terms of the loyal toast of the Belgian Royal Family at the banquet described above having been communicated to the King, Mr. A. F. P. Hayman received a telegram in the following terms, signed by the Captain Commanding, attached to the King's Cabinet: The King and Queen were touched by your loyal toast and the kind mention in it of the Royal Children, as well as by the enthusiastic reception accorded to your patriotic words in the course of the banquet given by your Company to the Belgian Gas Engineers and their foreign colleagues on the occasion of the International Gas Exhibition. Their Majesties have commanded me to thank you and all the guests most warmly.

The next general meeting of the Wales and Monmouthshire District Institution of Gas Engineers and Managers will be held at Barry on Wednesday, the 28th of May, when the President (Mr. T. E. Franklin) will deliver his presidential address and a paper will be read by Mr. E. A. Franks, of Ferndale.

ISLE OF WIGHT GAS ASSOCIATION.

Annual Meeting at Ventnor.

The Ninth Annual General Meeting of this Association was held at Ventnor on the 1st inst.—Mr. J. S. Ineson, the Engineer, Manager, and Secretary of the Ventnor Gas and Water Company, presiding.

The company assembled at the gas-works, which are close to the sea, from the sometimes very high waves of which they are protected by a strong sea wall constructed by Mr. Ineson.

The President welcomed the Association. He was supported by Mr. A. O. Scott, the only one of his Directors who was able to be present; the Chairman (Mr. V. G. Middleton) sending a letter of apology, with best wishes for the success of the meeting.

The minutes of the last annual meeting were confirmed.

The Chairman delivered an *extempore* address in which he referred to the continued success of the gas industry, the national coal strike and its lesson, the cultivation of a local sale of coke, the manufacture of sulphate of ammonia, naphthalene prevention by the use of "Gasine," the work of the British Commercial Gas Association, and the forthcoming gas exhibition to celebrate the centenary of gas lighting and the jubilee of the Institution of Gas Engineers. He also exhibited a curiosity in the shape of an old water-main constructed of papier-mâché and pitch, and laid under the direction of the late Mr. J. G. Livesay.

The report of the Management Committee was received; and, on the motion of Mr. Young, seconded by Mr. Scarr (Directors of the Sandown Gas Company), it was adopted.

The statement of accounts for the year 1912 was presented by the Hon. Secretary and Treasurer (Mr. E. H. Millard); and, on the motion of Mr. Scott, seconded by Mr. King, it was received and adopted.

Mr. Millard was re-elected to his official position, and Mr. W. Halliday was re-appointed Auditor; and both gentlemen made suitable replies.

A donation of a guinea was voted to the funds of the British Commercial Gas Association, on the motion of Mr. Ineson, seconded by Mr. Halliday; and it was resolved, on the motion of Mr. Falkner, seconded by Mr. A. E. Coombes, to forward a donation of two guineas to the Benevolent Fund of the Institution of Gas Engineers.

At the close of the business, the company partook of "high tea," after which there were some speeches interspersed with music. The toast of "The Chairman" was proposed by Mr. Church, seconded by Mr. Halliday, and carried by acclamation. The "Island Gas Undertakings" was submitted by the Chairman, seconded by Mr. F. King, and replied to by Messrs. Young and Scarr.

A vote of thanks to the Hon. Secretary brought to a close a very pleasant meeting.

SWISS ASSOCIATION OF GAS AND WATER ENGINEERS.

We have received the report issued by this Society of the transactions at the thirty-ninth annual general meeting, which was held on the 22nd and 23rd of September last year at Chur. The publication, which is very comprehensive, contains a full account of the business transacted, new officers elected, lists of members (active and honorary), besides the papers read and the discussions. It appears that 21 new members were added to the list, bringing the total up to 227. The chief paper in the brochure is an account of the industrial development of the town of Chur, with special reference to the gas, water, and electricity supplies. There is also an appendix, showing the results of exhaustive tests made for comparisen with ten different gas-cookers.

From the "Journal für Gasbeleuchtung" of March 1, we learn that the Association has issued statistics which show graphically the development of the more important Swiss gas-works from 1880 to 1910. According to these, the productions were as follows: 528,829,000 cubic feet in 1880, 918,930,000 cubic feet in 1890, and 2,092,584,000 cubic feet in 1899. In 1910, fifty gas-works produced 4,709,020,000 cubic feet, to which may be added another 162,380,000 cubic feet from thirty smaller works—making a total of 4,871,400,000 cubic feet for one year and eighty works, or about 3551 cubic feet per head of population. It is interesting to note from these statistics, continues the German journal, that in Switzerland, where of late years a decrease in gas consumption was to be expected, there has, on the contrary, been a considerable increase—in fact, almost ninefold since 1880. This upward movement by no means seems to have come to an end, as new concessions are constantly being granted for the erection of gas-works, as, for instance, quite recently in the Basle district.

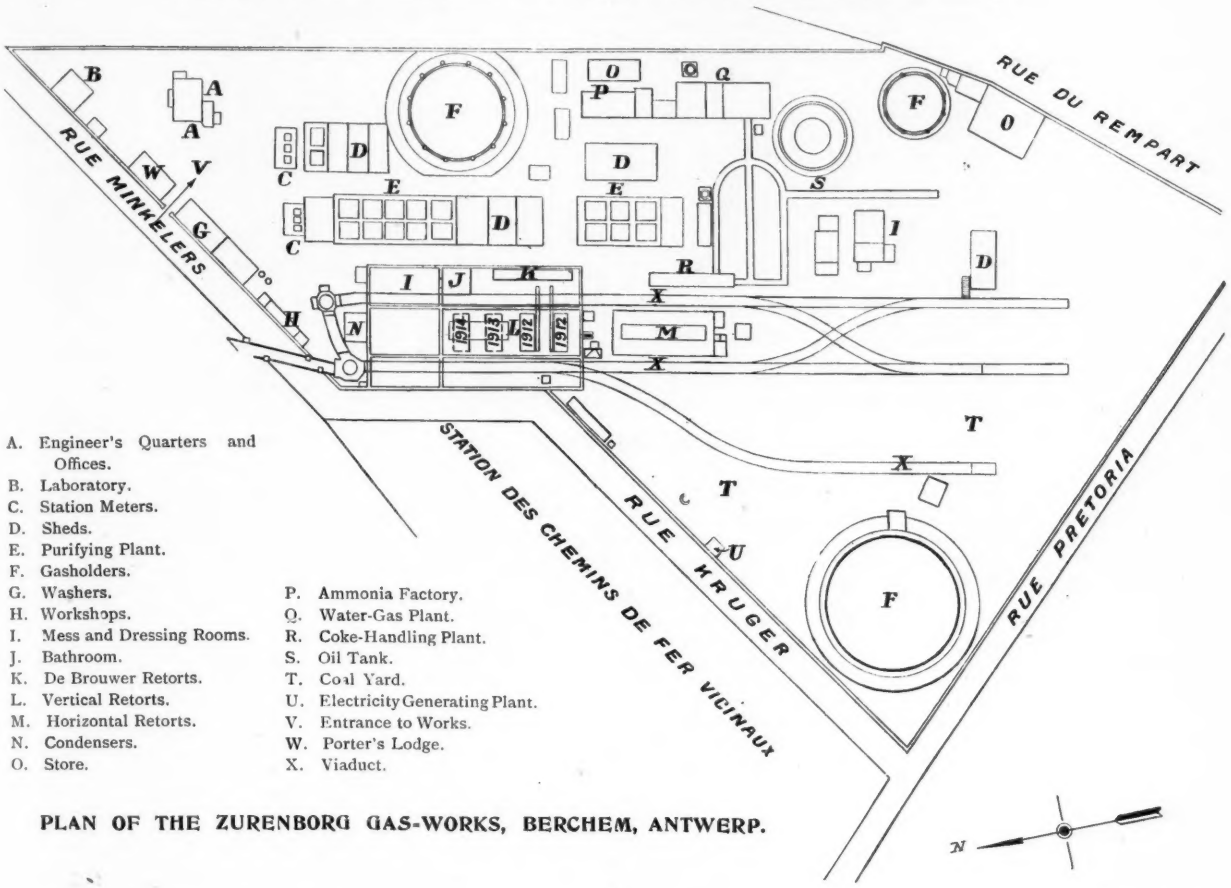
There will be a meeting of the Midland Junior Gas Association at the City of Birmingham Technical School next Saturday, at which Mr. N. B. Hodgkin, of the Fittings Staff of the Birmingham Gas Department, will read a paper on "High-Pressure Gas Distribution."

THE ANVERS-ZURENBORG WORKS OF THE IMPERIAL CONTINENTAL GAS ASSOCIATION

VISITED LAST WEEK BY THE ASSOCIATION DES GAZIERS BELGES.

[See pp. 661-2.]

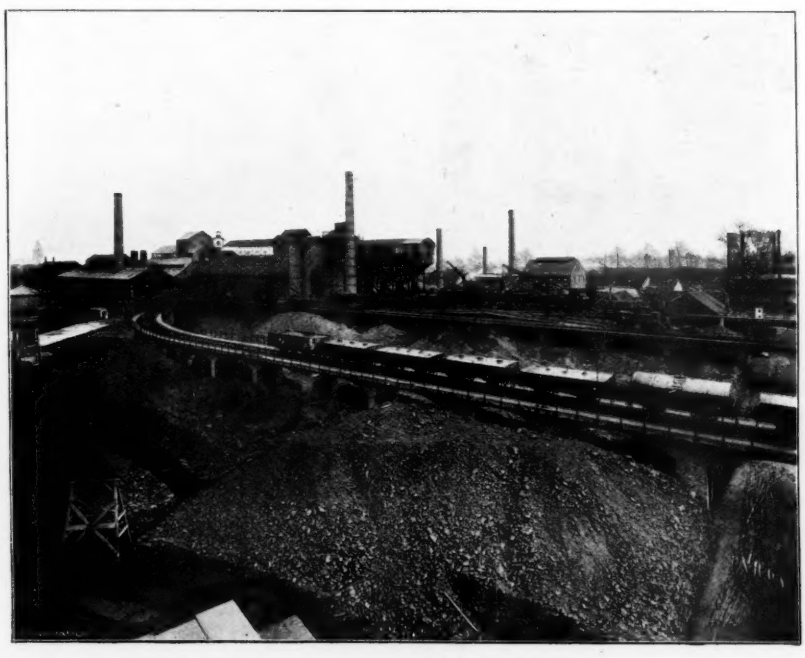
THIS is one of the three works of the Imperial Continental Gas Association which furnish the gas supply of Antwerp and the surrounding communes; the other two being the Anvers-Dam and the Hoboken works. A description of the last-named appeared in the "JOURNAL" for July 12, 1910. The construction of the works now in question was commenced in 1881. The maximum production here is 125,000 cubic metres (4,412,500 cubic feet) per diem, of which 35,000 cubic metres are carburetted water gas.



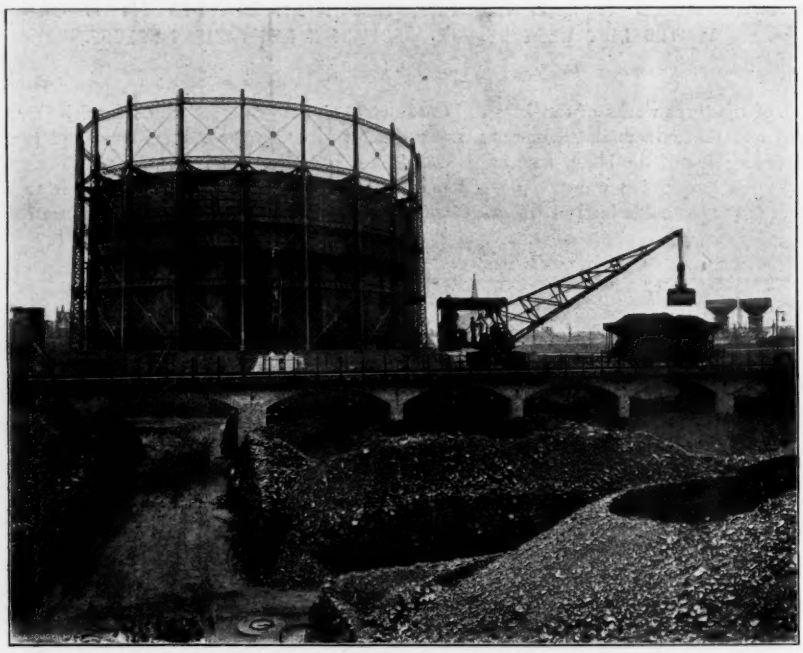
PLAN OF THE ZURENBORG GAS-WORKS, BERCHEM, ANTWERP.

COAL SUPPLY.

All coal arrives at the works by rail, and is discharged either directly into the bunkers feeding the breakers and elevators or else on to the store heaps by hand—an operation rendered easy by the fact that the rails are elevated and the branch lines well placed. Coal is removed from the heaps by a grab crane capable of manipulating about 25 tons per hour. From this, the coal is poured into a mechanically discharging waggon of 15 tons capacity, by means of which it is taken to the bunkers which feed the elevators and breakers. English, German, and Belgian coals are used.



COAL STORAGE YARD.



GASHOLDER OF 1,482,000 CUBIC FEET CAPACITY. AUTOMATIC WAGGON DISCHARGER.

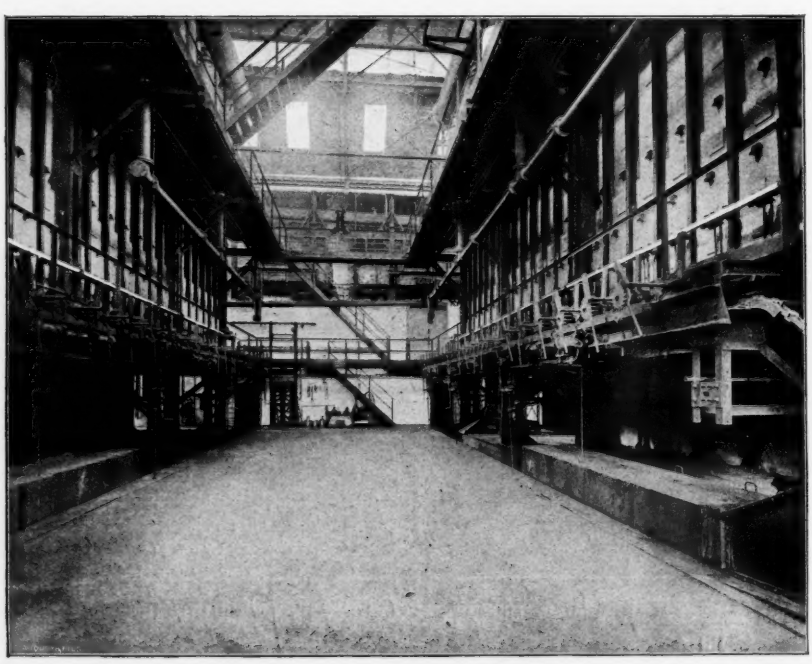
Carbonizing Plant.

From the building of the works up to 1906 various systems of horizontal retorts were installed, all of which have disappeared or are now disappearing. Eight settings of seven De Brouwer horizontals each, which were built in 1906, are still kept in reserve in a shed near the new retort-house. The installations at present in use are divided between two houses, one containing eight settings of nine 6-metre (19·7 feet) horizontal retorts, the other six furnaces of eighteen verticals each.

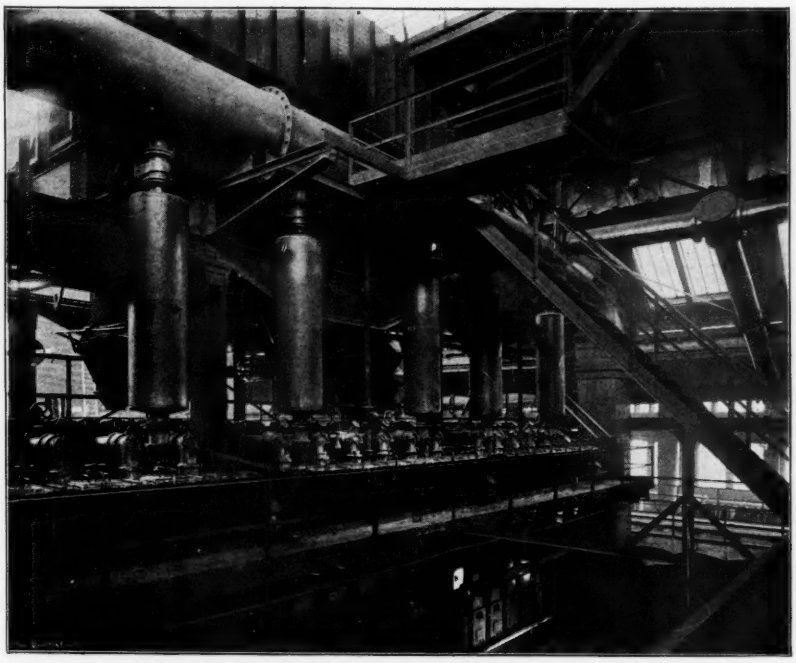
The horizontals, as well as the house containing them, were built by the Stettiner Chamotte-Fabrik in the year 1908. They are Ω-shaped and taper slightly, so that the section is a trifle larger at the discharging end. The coal passes an ordinary breaker, and is elevated to a raised bunker of 120 tons capacity, from which the charging machine is fed. The latter, as well as the discharging machine, is of the De Brouwer type. The coke is taken away by a De Brouwer conveyor, and the producers can be fed directly with the discharge from the retorts. Nine-hour charges of 13 cwt. are used. The producers are fitted with step-grates, and the furnaces are cleaned out by clinkering every six hours. All machines in both retort-houses are worked electrically. The second house has two settings of three furnaces each, with eighteen verticals 5 metres (16·4 feet) high to each furnace. They are of the Dessau intermittent type, and were erected last year by the Stettiner Chamotte-Fabrik and the Bamag Company, under the direction of the Dessau Company. Two more settings of capacity equal to these first two are to be erected, one in 1913 and the other in 1914. Breakers and elevators similar to those of the other house are used, and the coal is raised into a small tank, whence it is taken in little trucks to the bunkers above the retorts; it is then filled into the retorts through travelling hoppers. At the side of the coal hoppers are others for the coke used in the producers and for the bottom retorts. The retorts are rectangular, but with rounded corners, and taper towards the top. They are arranged in parallel rows of three, and the retorts of each row are discharged simultaneously. Twelve-hour charges of 9½ cwt. are used. The coke is removed by a De Brouwer conveyor as with the horizontals. The heads of the three retorts of a series are joined by a pipe of 6 inches diameter, which takes the gas through the hydraulic mains to pipes of large diameter, which serve as air-coolers and convey the gas to the condensers. The gas production is 6500 to 7000 cubic metres (229,000 to 247,000 cubic feet) per furnace per day.

Coke.

The coke coming from the retorts is conveyed either to the coke-breaker or to the adjacent night holder. That deposited in the night holder can, after being sifted, either be loaded on waggons, sent to the store-heap, or raised by lifts to the breaker. Coke can be taken to the jigging screen either direct or after being broken. The jigging screen is about 100 feet long, and



INTERIOR OF THE VERTICAL RETORT-HOUSE.



THE TOP OF THE VERTICALS—SHOWING THE CONDENSATION TUBES.

under it are the stores for six sizes of sorted coke, with a total content of over 350 tons. From them, it can be sent away in carts or by rail, or sold retail by measure.

Condensers, Exhausters, Washers.

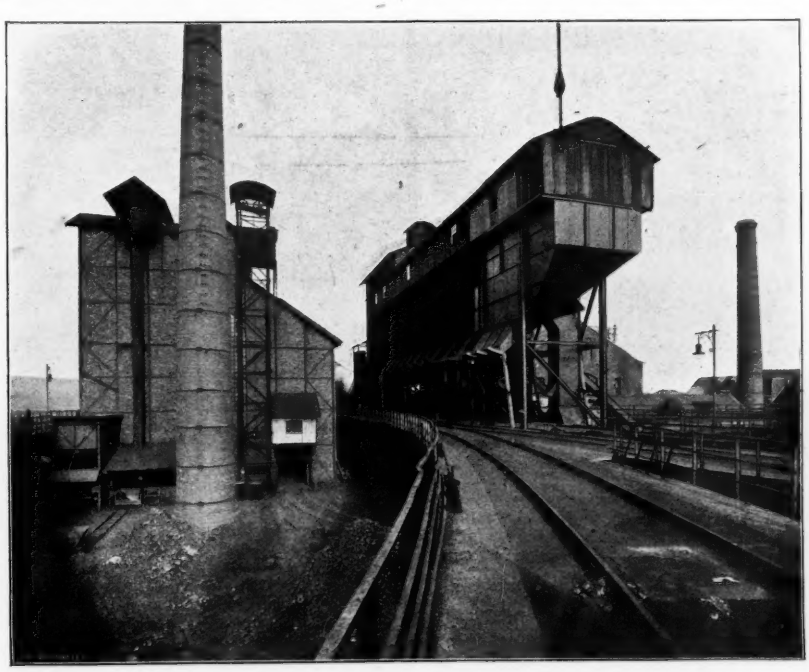
From the retorts the gas is taken to the condensers, which are in two sets, each containing one air and one water condenser; the former consisting of three vertical double tubes, nearly 30 feet high, with an interior diameter of 27 inches and an exterior diameter of 41 inches. The washers are by Kirkham, Hulett, and Chandler, being of the vertical type, but with horizontally arranged water tubes, 187 to each. The exhausters, four in number, take the gas after the condensers; they are driven by steam-engines, and have an hourly capacity together of nearly 200,000 cubic feet. The makers are Allen and the Bryan Donkin Company. The washers are eight in number, four for tar and four for ammonia. There are three Livesey washers for tar, using ammoniacal liquor, with a daily capacity of 2,753,400 cubic feet, and one Drory washer which can pass 1,500,000 cubic feet daily. For ammonia, there are two scrubbers and two "Standard" washers which can deal with 4,342,000 cubic feet daily.

Purifiers.

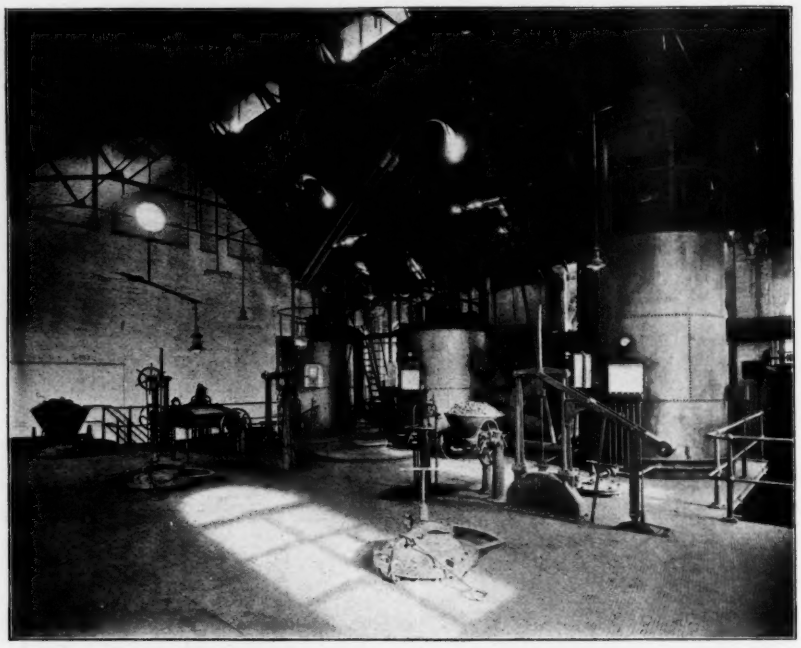
The coal-gas purifiers are divided into two series, each of four oxide and two lime boxes—the latter to remove the carbon dioxide as prescribed by the contract. All the boxes of the first series are roughly 24 feet by 24 feet by 5 feet. There are two gas inlets, one at the top of the boxes, the other at the bottom, and the outlet is between the two 20-inch layers of oxide. The same system is followed with the lime purifiers, except that there are four 7-inch layers of material. All these have water seals. The purifiers of the second series are raised above the floor, so as to facilitate emptying. They are formed by the division of one large box into six parts. Each portion has four lids with rubber joints. The gas passes upwards through four layers of material. This is raised by means of trucks on lifts—the oxide hydraulically, the lime by hand chains. The distribution is regulated by a Weck valve. A third series of the same dimensions as the first contains four lime purifiers for water gas, and two oxide boxes in reserve. The whole plant was supplied by Messrs. C. & W. Walker.

Station Meters, Governors, and Gasholders.

The station meters, six in number, are of various makes, including three from the meter works of the Imperial Continental Gas Association at Berlin. The four coal-gas meters have a total hourly capacity of nearly 160,000 cubic feet. Of the two for water gas, one is an ordinary meter, the other of the Duplex type, passing 1,765,000 cubic feet per diem. The gas leaves the works by three mains, two of 600 mm. (23·6 inches) diameter, the other 500 mm. (19·7 inches). The pressure in each of these is regulated by a water-pressure governor. The storage capacity of the works



THE COKE PLANT, WITH THE SHOOTS FOR CHARGING RAILWAY WAGGONS.



THE WATER GAS PLANT.

is 60,000 cubic metres (2,118,000 cubic feet)—a two lift holder, erected by Messrs. C. & W. Walker in 1881, taking 18,000 cubic metres, and one of three lifts, erected in 1895 by the Kölnische Maschinenbau A.G., having a capacity of 42,000 cubic metres.

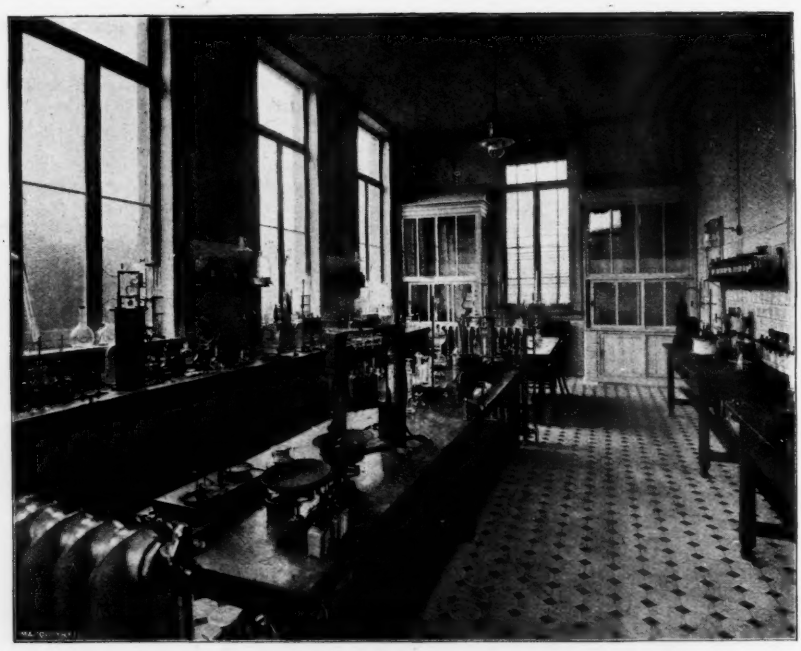
Carburetted Water Gas Plant and Ammonia Factory.

The plant for water gas consists of three sets of apparatus by Messrs. Humphreys and Glasgow, of a total capacity of 70,000 cubic metres (2,471,000 cubic feet). The gas produced is passed into a small holder, whence it is drawn by the exhausters through the tar washers, the purifiers, and the meters, after which it is mixed with the coal gas in the proportion of one to three.

The ammoniacal liquor is treated for the manufacture of sulphate of ammonia. About 18,700 gallons can be dealt with daily. The production of sulphate is roughly 1000 tons a year.

Laboratory, Workmen's Quarters, &c.

The comfort of the men is well provided-for with mess-rooms, dressing-rooms, baths, &c. The workshops are well fitted and able to meet all requirements. The laboratory has a special building for itself. On the ground floor is the chemical division and the balance room, and above are rooms for photometry of gas, tests of burners and mantles, calorimetry tests, oil analyses, photography, &c.



THE GAS ANALYSIS DEPARTMENT OF THE WORKS' LABORATORY.

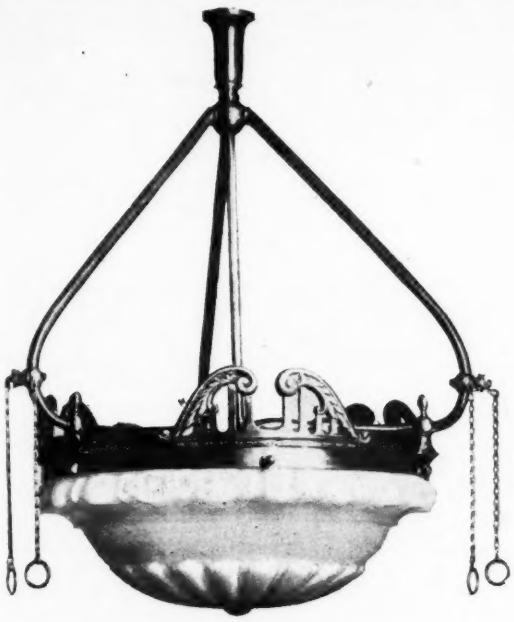
English Gas-Fires in Germany.

In the "Journal für Gasbeleuchtung" for Feb. 8 appeared another article by Direktor E. Körting, of Berlin, on the subject of gas-fires. It may be remembered that this eminent German gas engineer started a campaign last year in the German journal in favour of English gas-fires as against the reflector stoves which were almost universal in his country. After expressing his satisfaction at the interest that his previous article had evoked, Herr Körting proceeds to point out that the English gas-fire is well adapted to German conditions. He supports it from the hygienic and the economical points of view as against other methods of domestic heating. Many have been sold in Berlin, and the buyers have in all cases been quite satisfied with the results. Quoting the enormous increases in consumption of some of the London Gas Companies, the author remarks how desirable it is that the German stove companies should start manufacturing on the same principle. In spite of the great advances made with open gas-fires in the past few years, there is still room for improvement. Accompanying the article are illustrations of some types of highly ornamental gas-fires.

On the recommendation of the Gas Committee, the Burnley Town Council have agreed to increase the salary of Mr. J. P. Leather, the Gas Engineer and Manager, by £50 per annum.

SEMI-INDIRECT GAS LIGHTING.

THE adaptability of incandescent gas to the semi-indirect system of lighting—a method of which a good deal is being heard in connection with electricity—can be demonstrated to the satisfaction of anyone who will make a call at the Farringdon Road showrooms of Messrs. J. & W. B. Smith. It is a branch of the lighting business to which the firm are devoting special attention; and, as a result, they have some artistic patterns of semi-indirect gas-pendants on view—an illustration of one of which is given. This is made in two and three light patterns, and in several styles of finish. The burners are of the angle inverted type, similar to those used in the firm's "Silva" lamps, and are fitted with gas and air



Pendant for Semi-Indirect Gas Lighting.

adjusters. A point to be noted is that separate control to each burner is arranged, so that one or more lights can be used, as desired. An important part of the fitting is, of course, the bowl; and this is of the firm's special moulded "Pearlite" type. When lighted, the effect is extremely soft and pleasing to the eye—there being an absence of both glare and shadow; while in daylight both the pendant and the bowl (with its alabaster finish) present an attractive appearance. And, as has already been remarked, the fittings assist in showing that in connection with semi-indirect lighting, as in other matters, gas need be in no wise behind its competitor.

ECONOMY IN GAS COOKING.

Making the Oven Suit the Joint.

A POINT that has doubtless struck many people is that the gas-oven which is of sufficient capacity to deal with the household cooking on Sundays and holidays, when all the family are at home, is apt to be unnecessarily large for the mid-week requirements, when only small joints, &c., have to be dealt with. This is a matter that is worthy of consideration by the very great majority of persons—that is to say, those who are forced to study economy—for it means that for the cooking of a diminutive shoulder of lamb just the same oven space has to be heated as for a substantial joint of beef. Among others, Messrs. William Sugg and Co. have been impressed by the fact that here is a direction in which some saving worth securing might be made, without at the same time losing anything in the way of efficiency; and they have proceeded to devise a method of doing it.

The idea is a simple one; and, as seen by the writer at the firm's works in Regency Street, S.W., there appears to be no reason for doubting that the device will prove quite satisfactory in every-day use, in which case a large demand may safely be predicted for it. Messrs. Sugg and Co. are putting on the market a series of cookers embracing their new economizer; but it will be understood from the illustration and the following explanation that the arrangement is one that can be fitted to existing stoves. In fact, it should be largely in request for the latter purpose, as the fixing is a simple matter, and the cost of the whole of the materials necessary amounts to less than half-a-sovereign. Briefly the device consists of a second set of oven-burners, with an additional supply-pipe, &c.—giving the oven two sets of burners, and two gas supply-pipes. As will be noticed, the permanent bottom burners have their supply-pipe running down at the front of the stove; while the second set of burners receive their gas from a

The New Sugg Gas-Oven Arrangement.

pipe running down the back, so that there is no need to fear the turning on of the wrong tap. The second set of burners are fixed on a sliding shelf which, when used, is put into position in the centre of the oven—thus reducing the oven-space by exactly one-half, and the consumption of gas necessary for heating it by something more than one-half. There are no connections to make—simply slide the shelf into position, and the burners then adjust themselves to the gas supply by means of the ejectors which pass through two holes drilled in the back of the stove. The drilling of these two holes, and one in the float at the top of the stove, is practically all the work that has to be done in adapting the idea to existing stoves. The burners are provided with a simple and effective form of air-regulator; and there is nothing whatever that is likely to get out of order.

THERMOMETRY.

AT the Meeting of the London Section of the Society of Chemical Industry, on Monday last week, Mr. J. H. COSTE, F.I.C., read some "Notes on Thermometry." His remarks had reference to the use of thermometers for general laboratory purposes. In so far as the use of thermometers in fuel calorimetry was concerned, he referred to the paper read by Mr. G. Nevill Huntly on the "Accuracy Obtainable in Fuel Calorimetry" in June, 1910. [See "JOURNAL" Vol. CX., p. 699.]

Mr. Coste said that for general laboratory purposes the mercury thermometer was reliable up to 300° C. The errors of most importance, which depended mainly on the kind of glass used in the thermometer, were those due to the deviation of the scale from the hydrogen scale, and the depreciation of the zero after heating. The author showed curves indicating the extent of these errors for the descriptions of glass mostly employed in thermometers. Generally speaking, the boro-silicate glass used for high-temperature thermometers was particularly good. This glass contained about 72 per cent. of silica, 5 per cent. of aluminium oxide, 12 per cent. of boron trioxide, and 11 per cent. of soda. The French hard glass, of which standard thermometers are made, contained about 72 per cent. of silica, 14 per cent. of lime, and 11 per cent. of soda. There was little doubt that fused quartz would ultimately replace glass for the higher class of mercury thermometers, on account of its low coefficient of expansion. The cumulative error of the various errors to which thermometers were subject might be considerable. An accuracy of 0·01° C. or less on a single reading was not easy to obtain. For an accuracy of 0·1° C. the errors which had to be considered were those of deviation from the hydrogen scale, the change of zero, and of the fundamental interval. Where an accuracy of 0·5° C. was adequate, the only error that came into account was that due to the emergent column. As to high-temperature work, the author said he had found an error of about 28° in boro-silicate thermometers at a temperature of 500° C.

A discussion ensued, in which Professor W. R. E. Hodgkinson, who was in the chair, Mr. Powell, of the Whitefriars Glass-Works, Mr. W. F. Reid, Mr. A. C. Chapman, Mr. W. J. A. Butterfield, and others took part.

Among the lectures to be delivered at the Royal Institution after Easter are two by Mr. H. A. Humphrey, on the internal combustion pump bearing his name.

COAL GAS AS A FUEL FOR DOMESTIC PURPOSES.

By F. W. GOODENOUGH, Controller of Gas Sales of the Gaslight and Coke Company.

In accordance with the announcements which have appeared in the "Journal," Mr. F. W. Goodenough delivered, before the Royal Society of Arts, on March 3, the first of two Cantor Lectures on "Coal Gas as a Fuel for Domestic Purposes." On this occasion, the lecturer dealt with the substitution of gaseous for solid fuel in the home, from the points of view of public health, personal health, and comfort, and domestic economics and labour saving, and traced the evolution of the gas-fire, combated the prejudices against it, compared the open fire with other systems of heating, and dealt with radiant and convected heat and the relation of heating to ventilation.

The subject of my lecture is not one that can vie in its romance or in its scientific wonders with many of the themes that have fascinated audiences in this room under the auspices of this famous Society, which has done so much for the advancement of arts, manufactures, and commerce. It can, however, claim to be one that is of interest and importance to the vast majority of the inhabitants of this country, from the unskilled labourer, his wife, and children, to the most scientific, learned, and cultured men and women in the land; for it is one that has a direct bearing upon their health, their comfort, and their convenience, and last, but by no means least, the state of their pockets.

Fire has been the welcome servant and valued friend, as well as the most dreaded enemy, of man from time immemorial. There is no historically verified record of any savage tribe, even in the tropics, with no knowledge of fire. The art of cooking is nowhere unknown, not even to the cannibal; and our rude forefathers doubtless learned the art of making fire when they were chipping flints to make domestic and less peaceful implements. Fire and the means of kindling it find place in the earliest records, and have furnished the speech of man with metaphor from the beginnings of all languages. To mention only one or two instances in the classics, we find references to the use of the burning-glass in "The Clouds" of Aristophanes, and as schoolboys we gloried in the idea of using a mirror, as did Archimedes, wherewith to set fire to the enemy's ships; while the Virgins of the Sun in Peru are credited with having used a glass concealed in a large bracelet for the kindling of sacrificial fires. If this were but a sunnier clime, we might perhaps see their artifice revived to-day by the Virgins of the Vote!

Origin of Fuel.

The fuel employed for the production of heat has very generally been some form of vegetable matter. I may be told by some that this generalization excludes petroleum and its derivatives. But when doctors differ, the mere layman may surely be permitted to give himself the benefit of the doubt; so I will take shelter behind the by no means inadequate authorities who have pronounced petroleum to be the product of distillation from vegetable matter.

The natural evolution of fuel as generally used may with no serious degree of inaccuracy be described as being from air-dried wood, through artificially-dried wood (charcoal), partially compressed, but moist, vegetable matter (lignite), to the fully compressed vegetable matter which we call coal; thence, by artificial, instead of natural, means, to the fiery essence of coal in the form of gas—a word derived, we are told, from the Anglo-Saxon "gast" or the German "geist," each meaning spirit or ghost. Who shall say that the gas-fire cannot rival the coal-fire as a source of inspiration for dream and reverie, when it is remembered, as we gaze into its crimson glow, that it is the ghost of former sunshine released from age-long imprisonment in the bowels of the earth that is being restored to warm life for a moment before being re-absorbed into Nature's store of indestructible elements?

Gas, the Vital Essence.

In every stage, the gas volatilized in the process of combustion from the substance consumed has given the vital flame. When, therefore, we arrive at the stage of being able to buy the vital essence of coal unencumbered by the grosser body in which it was imprisoned, surely we have got very near to the ideal fuel. This vital essence which we call gas is, moreover, as supplied to the public, the purified essence of the crude coal. What does this mean?

Purifying the Atmosphere.

It means that when the essence of coal is burned in our houses, our chimneys emit into the atmosphere none of the tarry vapours that arise from the smoky fire, because at the gas-works from every ton of coal there have been extracted somewhere about 10 gallons of tar—to be used, not for helping to defile the air, but, perhaps, for helping to keep it free from the dust of the country road. The absence from the atmosphere of these tarry vapours tends to reduce materially the risk of the formation of dense fog.

Again, the burning of the purified essence of coal instead of the crude article means that when the (say) 12,000 cubic feet of gas extracted from the ton of coal are burned in our fire-places and kitchen stoves, instead of the 33½ lbs. of sulphur that would be discharged into the air were this quantity of coal burned in crude form, only ½ lb. of sulphur—not more than 1½ per cent. of the quantity originally in the coal—goes into the atmosphere; some 32½ per cent. remaining in the coke, while 66 per cent. is converted into valuable fertilizing material, to enrich our national agricultural resources. It should be added, moreover, that the small percentage of sulphur which a gas-fire discharges up its flue is only in the form of sulphur dioxide, without the addition of considerable quantities of sulphuretted hydrogen and ammonia, as is the case with the ordinary coal-fire, which also emits such noxious products as formic aldehyde and carbon monoxide—unknown in the flue gases from a gas-fire.

The Destructive Coal-Fire.

The destructive effect of the products of combustion in the case of gas-fires compared with coal-fires is therefore not only less by reason of the enormously diminished quantity of sulphur, but also because the sulphur compounds emitted from the coal-fire are, by reason of the presence of ammonia in company with the sulphur, more destructive in their action than in the case of sulphur dioxide unaccompanied by sulphuretted hydrogen and ammonia. Moreover, if we use the essence of coal instead of the crude substance in our fire-places, we discharge into the air no unconsumed carbon, as we do in such large quantities when we carry on our carbonization of the coal in an open grate, instead of in a closed retort.

Wasting our Coal Supplies.

Observations recently carried out by the Coal Smoke Abatement Society showed that no less than 61,000 tons of solid matter are deposited annually on every square mile in the City of London, and that a very large proportion of this is wasted carbonaceous matter which has its origin mainly in the domestic coal-fire and kitchen grate. Dirt has been described as "matter in the wrong place," and it is doubtful if this is ever more true than in the case of the emanations from a smoky coal-fire; whereas a gas-works, with its entire absence of any waste material as the result of its processes of manufacture, is a striking example of the allocation of matter to its right place and use.

Obviously, therefore, the universal use of gas instead of coal as a domestic fuel would have a very marked effect in diminishing the amount of dark fog from which our cities suffer. In London, and in many cities, it is inevitable that we should have mists under certain conditions of barometer and thermometer; but the difference between mist and fog is a very wide one. It is not many weeks since we in London had an example of day being turned into night by the smoke of our City being arrested by a current of cold air just above our heads, with a result more satisfactory to the suppliers of illuminants than to anyone else.

The Influence of Gloom on Health.

It is not easy to estimate—it would, I think, be difficult to overestimate—the hygienic value of light, of sunshine, and clean air. It is impossible to measure, though not difficult to realize, in general terms the effect upon our health and upon our wealth of a diminution in the rays of daylight and sunlight. It is a matter of general experience that darkness, especially unseasonable darkness, tends to depress the mind and lower the vitality; and it is no exaggeration to say that on a densely foggy day the value of the work done by every human being in the City is very materially lower than on a day when the sun is shining and the air is clear and crisp.

It is a matter of common knowledge that there is always more sickness towards the end than at the beginning of a winter. Vitality is lowered by darkness and absence of sunshine; and the effect of the summer sun, and of the holiday spent in the open air and sunlight, fades gradually under the influence of winter gloom; and man's power of doing work and resisting disease becomes perceptibly diminished. He who causes the sunshine to penetrate to our streets and homes for five minutes a day more than it did before is indeed a benefactor to mankind. We may, therefore, looking back over the century during which coal gas has been at the service of man, lay our tribute of thanks at the shrine of Murdoch and other pioneers of the gas industry.

The Cost of a Fog.

Apart from the question of health, it must not be forgotten that artificial light is costly, and that a day of darkness in London, such as we witnessed a little more than a fortnight ago, probably costs the inhabitants £5000 for gas, as well as a very large sum for electric light.

There are further sides to the economic aspects of smoke-laden, as compared with the clean, atmosphere. One is the damage wrought on public buildings by the action of a sulphurous atmosphere. Another is the heavy cost of cleaning all white and light-coloured fabrics, which so much more rapidly become

discoloured in the smoke-laden air of a town than in the undefiled air of the country. This latter point is, of course, also an argument in favour of the use of smokeless fuel from the point of view of the interior of the house, because where there is no smoke and no handling of coal or ashes, the laundry and cleaners' bills are perceptibly lower than under the conditions that were universal in the times of our forefathers.

Fog Diminishing in London.

It is, of course, a fact, as has been freely commented upon by other speakers and writers on the subject of smoke abatement, that the intensity and duration of fogs in London have diminished materially in recent years, owing to the rapid displacement of coal as a fuel by its purified essence. In the twenty years from 1891 to 1911, the number of gas heating, cooking, and hot-water appliances sold, hired, or loaned to their consumers by the Metropolitan and Suburban gas companies increased from 46,000 to 1,494,000. In the year 1912, the number increased by at least another 100,000; and the process still goes rapidly on. The result of this steady progress towards the total elimination of the smoky chimney is well illustrated by a diagram which was recently compiled by Mr. J. D. Falkner. The advantages of smokeless over smoky fuel being granted as obvious from the point of view both of public health and economy, there naturally arises the question: What are the practicable and desirable alternatives to smoky fuel for domestic purposes?

The Alternatives to Coal.

My answer is: Coal gas, with the assistance of coke in certain conditions and circumstances. Coke is, at normal prices for both, cheaper for constant use than gas; but as it is outclassed by gas for certainty, regularity, and flexibility of heat, and as gas has the advantage over coke of entailing neither dirt nor labour, coke is only a serious competitor of gas in the home (*a*) where coal continues to be used for the purpose of the kitchen fire in the winter, when a large mixture of coke with the coal is distinctly advantageous; (*b*) where the demand for hot water in the household is considerable and fairly continuous, when a coke-heated boiler connected to the hot-water circulation system in the house is the cheapest and a very convenient method for ensuring a good and constant supply of really hot water independently of the kitchen range; and (*c*) where, owing to the size of the rooms, the open fire needs augmenting by low-temperature radiators. The last of these points is the only one upon which I shall be touching in this lecture.

There are large fields for the advantageous and economic use of coke; and there is no question of coal gas displacing coke in the many places where it is used with economy at the present time. As a domestic fuel, however, coal gas has a much wider field of usefulness than coke.

I should no doubt be regarded as a prejudiced person in referring to the possibility of electricity proving a serious rival to gas as a domestic fuel; but no one who has studied the figures which Mr. Darling gave in his recent lectures in this room, as to the relative amount of heat procurable from the quantities of gas and electricity that can be obtained at the prices at which the two sources of heat can be supplied with profit, and no one who has taken the trouble to verify by practical tests (as they can be verified) the figures which Mr. Darling gave, can regard electricity as being in any sense at present, or as likely to be in the future, a serious competitor of coal gas in regard to its use as a domestic fuel.

It is not, as in the case of illumination, a question of infinite possibilities. The possibilities in the case of converting any form of potential energy into heat are strictly limited and defined. You cannot get, be you never so profound a scientist or skilled an operator, more heat out of a pound of coal than its complete combustion will give; and the same applies to any given quantity of any other form of fuel. Electricity as a heating agent has its field; but it is a limited one, until at any rate the current can be supplied at a mere fraction of its present cost.

Smokeless solid fuels, other than coke—such as coalite, carbo, and other similar forms of incompletely carbonized coal—have hitherto proved too costly in manufacture to command anything but a very restricted market.

Oil-stoves have their use, more particularly in country cottages; but they also have their disadvantages, and are not found to be displacing coal in any serious manner in cities where coal and gas are at reasonable prices.

Closed anthracite and coke stoves also have their users and their advocates; but I cannot regard them as suited, either in regard to convenience or comfort, for use in this country of intermittent seasons, even if they were not open (for apartment heating) to the grave objections attending the use of all high-temperature convection heaters to which I shall presently have occasion to refer.

The Domestic Fuel Problem.

The question then, in my opinion, speaking broadly, comes down to this: To what extent can coal gas at ordinary town prices be adopted in place of smoky fuel in the home with advantage to health, comfort and convenience, and economy? The problem of fuel in the home divides itself into the question of fuel for cooking, and other kitchen or laundry purposes; fuel for the supply of hot water; and fuel for heating the various parts of the house. This evening, I can only deal with the question of gas as a fuel for the heating of the home.

A "Lancet" Commission.

The case for gaseous fuel on the side of comfort and convenience hardly needs to be argued or enlarged upon. It was summarized effectively twenty years ago by the Special Analytical Commission which was appointed by "The Lancet" to report upon "Smoke Prevention and Perfect Combustion." In the report of this Commission, which has become a classic on the hygiene of gas heating, and to which all who have the smoke abatement movement at heart owe a very substantial debt of gratitude, the manifold advantages of gas over coal-fires are thus referred to: "None will deny the convenience of such system. With gas, a bright fire can be obtained at any moment, night or day. The heat can be regulated to a degree, the fire can be stopped at will, the conveyance of coals dispensed with, and the often-times troublesome process of lighting with wood and paper is avoided; while cleanliness is an inevitable result of a gas installation."

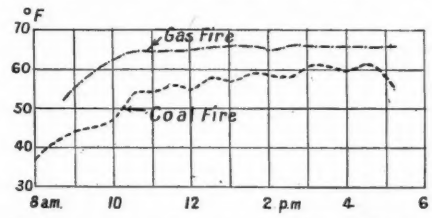
The Question of Comparative Economy.

The report proceeded to touch upon the question of economy, by adding that: "At first sight it would appear that gas as a fuel compares unfavourably with coal in regard to cost; but when all the features—cleanliness, convenience, and manipulative advantages—are taken into account, when the *pros* and *cons* are considered in minute detail, it is probable that gas used rationally runs coal very closely, even on the score of expense."

This is an aspect of the question which was also referred to in the report made to the Coal Smoke Abatement Society in November, 1906, upon an experimental inquiry conducted by two eminent medical men—Dr. Des Vœux and Dr. Owens—into the thermal efficiency of, and hygienic considerations relating to, the use of gas-stoves. In this report, it was pointed out that when the initial raising of the temperature of the rooms in which the experimental inquiry was conducted had been accomplished, and the fires had produced a fairly steady rise, the cost per hour for each degree of rise in temperature was about four times as great with gas-fires as with coal. "This," the report went on to point out, "does not necessarily mean that gas is always more costly than coal; other factors must be considered, such as the rate at which the room is warmed."

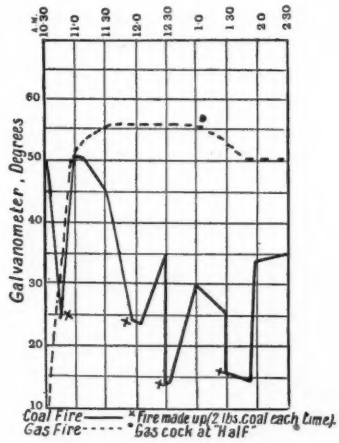
Comparative Temperature Conditions.

It was found that while the gas-fires usually produced a fairly steady temperature in the rooms in from one to two hours, the coal-fires took much longer. This was clearly shown by charts set out in the report. From those charts, I have had prepared a

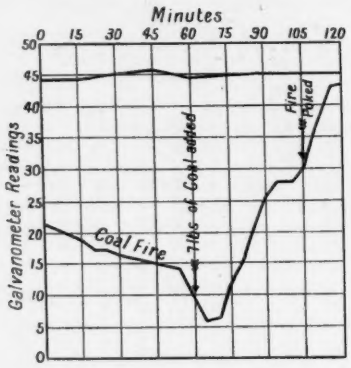


Showing Variations of Room Temperature with Gas-Fire and Coal-Fire.

diagram showing the comparative rises and falls in the temperature of a room with a coal-fire and a gas-fire. Even more striking than this diagram are two others which I have taken from recent issues of the "Gas World," as illustrating the results of some experiments made by Messrs. Webber and Brearley, respectively, as to the comparative steadiness of the radiant heat given off by a



gas-fire and a coal-fire. These show how much more regular is the temperature of a room heated by a gas-fire—a point which is of material importance in cases of sickness, and has a distinct bearing upon comfort and convenience in every-day life.



It is, for example, distinctly uncomfortable, as well as considerably inconvenient, when one is working late on a winter's night and the servants have gone to bed, to have brought suddenly to one's notice, by an unpleasant sense of chilliness, the fact that, while one has been absorbed in one's work, the fire has gone out, and one has either to work on in great discomfort, and with risk of chill, or else abandon work—perhaps at an inconvenient time.

Control of Temperature.

The report of the Coal Smoke Abatement Society adds that another point in favour of gas-fires is that they can be easily regulated and the heat of the room controlled in a way which is not possible with coal-fires. This, in a climate such as ours, is a very distinct advantage, as it is often grateful and comforting to be able to have a fire for the first hour in one's office when the day opens with a frost, and to be able to turn it out when the sun comes out—to be relighted, perhaps, for the last hour of the day's work, when the chilliness of the evening creeps on. You cannot quickly adjust your heating arrangements to the thermometer if you have only a coal-fire at your disposal.

The report proceeds to say that, "taking into consideration the amount of coal which must be burned before a comfortable and steady warmth is produced, and also the amount which must be burned after the fire is no longer required, the examiners think that, even from the point of view of economy, gas would run coal very closely for domestic uses, where it is seldom necessary to have a fire constantly burning for long periods." "It is," they add, "the lighting and letting out which make a coal-fire wasteful; whereas a gas-fire can be lighted and turned out when it is required without unnecessary waste of fuel."

The Economic Aspect.

Here it seems appropriate to say something more upon the important question of comparative cost as between coal and coal gas for fuel. This is a question of domestic economics, and also of national welfare, which it is very essential should be seen as a whole and not in parts. It is not a question merely of gas bill *v.* coal bill, but one of the household budget as a whole. Let me give one instance from my experience to illustrate what I mean. I was visiting an important nursing home in the Harley Street area some years ago, and my attention was naturally at once arrested by the fact that throughout the home gas-fires were in use. I commented on this to the proprietor, who replied: "Yes, they are wonderfully convenient and cleanly; but my gas bill is a pretty stiff one, I can tell you." I said: "But doesn't it save you a lot of work in the house?" To which the reply was, "Oh, certainly, I was able to get rid of one maid directly the gas-fires were put in."

Saving a Servant—and the Rest.

I said no more at the moment; but next day, having ascertained that the gas bill for the home amounted to about £40 a year, I pointed out that this was not much to set against the previous coal bill, *plus* the wages and keep of a maid—certainly not less than £50 a year. The proprietor then realized that she was financially considerably to the good, in addition to having a cleanly system of heating, which she could rely upon to keep a patient warm all night without either the cost or the noise of someone sitting up all night to make up the fire.

But it is not merely a question of whether by adopting smokeless in place of smoky fuel you can economize in servants—though this is a very important one to very many households throughout the country—it is one of whether by this means you can so lighten and improve the conditions of domestic service as to check the constant and growing tendency of the girl who has been decently educated and brought up to refuse to consider domestic service as a calling worthy of her ability.

Business Principles in Home Affairs.

Personally, I look to the time when domestic service shall not be considered inferior to the civil service as a field for women's activities—when a girl will be as proud to be a cook or parlourmaid as to be a post office clerk or telephone girl. But this time can never come until appliances for the saving of unnecessary work and drudgery are as readily installed on that account in the home as they now are in office, factory, or workshop. That is why I say that this question of smokeless fuel is one not only of domestic economics, but also one of national well-being. But to return to the report of the Coal Smoke Abatement Society.

The Hygienic Value of Gas.

The examiners express the opinion that a properly constructed gas-fire has the advantage of a coal-fire from a hygienic point of view, owing to the more equable temperature and the absence of dust and smoke. The essence of their conclusions is, in short, found in these words: "A properly constructed gas-stove, with a flue sufficiently large to carry away the products of combustion, although for constant use more costly than a coal-fire, is quite as satisfactory from a hygienic point of view, and does not in any way vitiate the air of a room, nor does it produce any abnormal drying effect, as is popularly supposed. It will carry off from 2000 to 4000 cubic feet of air per hour; and this is a valuable ventilating effect"—but one, be it noted, that does not entail the cutting draughts caused by a blazing coal-fire. It is true that this ventilating power of a gas-fire is sometimes described, by those who are not perhaps exactly its friends, as "consuming the oxygen in the room;" but as this applies with equal or greater force to the coal-fire, and would only mean anything if we shut ourselves up in air-tight compartments (when it would not matter very much what system of heating we adopted, as we should very soon be dead), I think everyone will regard the flue draught from a gas-fire in the same light as the doctors from whose report I have been quoting—namely, as "a valuable ventilating effect."

This brings us directly to the consideration of the very important question so often either asked or reserved as a doubt militating against the smoke abatement movement: Can gas be used in place of coal without disadvantage from the hygienic point of view? There can be no doubt, as a result of the research that has been carried out on this question, and indeed from a commonsense consideration of the matter, that gas-fires not only have no hygienic disadvantages over coal-fires, but, on the contrary, have a marked superiority in that respect. Here I am speaking, be it noted, of the gas-fire as constructed, fitted, and maintained to-day. The public prejudice against gas-fires—as being smelly, costly, and horribly ugly pieces of domestic furniture—had no little ground in bye-gone days, and has grounds still where fires of old design have been badly fitted and worse looked after.

The Old Gas-Fire and the New.

An explanation of the difference between the old and the new will be better understood if I first of all emphasize the good points of the modern gas-fire. The one great point in favour of the modern gas-fire (because it embraces the others, which contribute to this result) is that it gives its warmth mainly in the form of radiant heat; doing only a moderate amount of heating by convection and that at a low temperature, while at the same time it acts as a valuable ventilating instrument for the room in which it is used.

Radiation versus Convection.

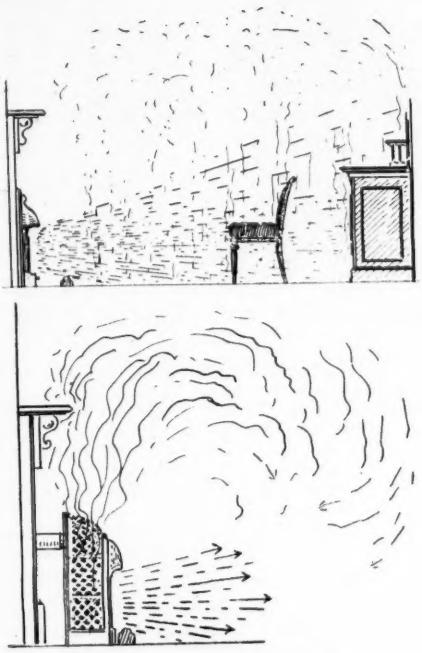
The question of the difference between heating by the radiant open fire and by appliances that depend for their effect upon heating by convection is one of which it is difficult to exaggerate the importance. I will do my best to make this vital difference as clear as possible. Heating by radiation is Nature's method of heating—it is the method by which the sun gives us warmth. Radiant heat (and I am here referring to the heat given off by an incandescent body such as a brightly burning coal-fire, or a gas-fire, or the sun) differs from convected heat, which is the heat conveyed to the air by contact with a solid body, in the essential feature that the radiant heat passes through the air without directly affecting its temperature, and only raises the temperature of heated objects with which it comes in contact. This can be quickly demonstrated by a galvanometer.

You are all familiar with the great difference in the temperature registered by a thermometer in the sun from that registered by a thermometer in the shade, even though the two thermometers be only separated by a few inches, and are both enveloped by practically the same air. You all know that if you are sitting in front of a glowing fire, it only needs a thin fan to protect your face from the scorching effect of the fire, though the air surrounding your face remains unchanged. You know how cold you can feel if some kind friend stands on the hearth rug between you and the fire. Those of us who are familiar with high altitudes know what it is to walk up a mountain path in the morning with icicles a foot long hanging from the rocks on the shady side of the road, while one is getting gloriously burnt in the rays of the sun; and we have seen the icicles melt away rapidly when the rays of the sun have eventually fallen upon them.

A Comfortable Room.

If, then, we sit in a room which is heated mainly by radiant heat, we are in a room where we ourselves, the walls, the furniture, the floor, and the other solid objects are raised in temperature by the radiant heat that falls upon us and them, while the atmosphere remains unaffected directly by the heat of the fire, and is only raised gradually and comfortably in temperature by contact with the warmer objects in the room. As bodies of higher temperature radiate their heat to bodies of lower temperature, it is obvious that the human body at a temperature of 98° will lose its heat less rapidly to objects which are at a temperature of between 60° and 70° than they will to objects between 30° and 40°. A room heated by radiation is, therefore, from this point of view, more comfortable to sit in; and when we proceed to consider that

the raising of the temperature of air increases its capacity for absorbing moisture, we begin to realize another very important aspect of the difference between heating by radiation and heating by convection.



What is a "Dry Atmosphere"?

The term "dryness of air" is often misconstrued. It does not mean that a "dry atmosphere" necessarily contains less water vapour than a wet atmosphere, but that its degree of saturation—*i.e.*, the proportion of water vapour present in the air to that necessary to produce complete saturation—is less. This distinction is rather important in connection with the maintenance of any desired degree of humidity when considered in conjunction with the subject of warming. The capacity of air for water vapour varies enormously with the temperature, as is shown by the following table.

Temperature of Air. Deg. Fahr.	Vapour Tension. Ins. Mercury.
40	0·247
45	0 299
50	0·360
55	0·432
60	0·517
65	0·617
70	0·732
75	0·867

If, therefore, air at a certain temperature and with a certain degree of humidity becomes warmed, its humidity must necessarily decrease providing no measures are taken to add water vapour to compensate for the increasing temperature.

Radiators which do not Radiate.

In a room which is heated by those forms of heating apparatus which are called radiators—chiefly, it would seem, because they are heated by convection and not by radiation—or by hot-water pipes, or by having warmer air poured into them, the body is losing heat more rapidly to the surrounding objects, because they have not been raised in temperature by radiant heat, than it would in a room heated by a radiant fire; and the body is losing moisture more rapidly to the air from the skin, the eyes, the membrane of the nose and throat and lungs, than it would in a room where the air is kept at a moderate temperature. Is it, then, to be wondered at that in a room heated by convection methods one so often gets cold feet, a hot head, a thirst, a headache, and a general feeling of lassitude?

The Advantage of the Open Fire.

The open coal-fire (when it is in a state of glowing radiation) and the open gas-fire approach most nearly to Nature's method of heating; and, therefore, possess enormous advantages, from the point of view of health and comfort, over other systems of artificial heating that depend for their effect upon the warming of the air of the rooms. This subject has been brought prominently to public notice of late by more than one eminent scientist, but more especially by Professor Leonard Hill, who, in his Presidential Address to the Physiology Section of the British Association at Dundee last autumn, gave it as his opinion that far more important than the chemical purity of the air of a room was the question of movement of the air, and the keeping of the air of the room down to a temperature at which the body parted with its moisture at a rate that was normal and agreeable.

A "Comfort-Meter."

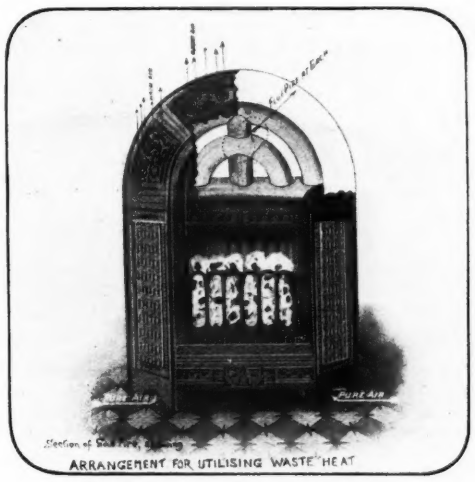
Professor Hill has since announced his construction of an instrument which is called a "comfort-meter" for indicating the condition of the atmosphere of a room in its relation to that condition which is essential to the comfort of human beings in it. I understand that Professor Hill is about to carry out some research with this ingenious instrument on rooms warmed by different systems of artificial heating. I have no doubt that such research would reveal the fact that the open gas-fire (which is, after all, only an open coal-fire burning purified, instead of unpurified, gas) produces and maintains a comfortable condition of atmosphere more completely and surely than any other system of artificial heating. It was because the old-fashioned gas-fire did so much of its work by convection heating at high temperature that gas-fires got the reputation of drying the air of a room.

The Evolution of the Gas-Fire.

This brings me to an account of the evolution of the gas-fire from its older to its present form. The gas-fire, as distinct from gas-heating stoves, which in one form or another have been in use almost ever since gas was first supplied to the public, came into being as the result of the invention of the bunsen burner, whereby, as you are all aware, owing to the introduction of air into the gas prior to its ignition, the complete combustion of the gas was made possible in spite of the flame coming into contact with a solid body.

The Old Type of Fire.

The original type of gas-fire (by which term, in contra-distinction to a gas-heating stove, I mean a warming apparatus in which the heat of the gas is utilized to raise some refractory substance to a glowing heat, and the products of combustion are carried off by a chimney or a flue for discharge into a chimney) was of a form generally on the lines of the drawing, which illustrates a section



ARRANGEMENT FOR UTILISING WASTE HEAT

of such a fire. It will be seen that the products of combustion were conducted through a series of tubes in the top of the stove which were covered over by open metal work, making a chamber in which the air was heated to a high temperature by contact with the heated tubes. The fire-clay back of the stove was set back sufficiently far from the line of the front of the burners to permit of a large quantity of fire-clay balls being placed above the burner for the purpose of being heated by the gas, and the canopy of the stove came well down towards the top of the fire-clay lumps.

The arrangement of the fire-clay bore no precise relation to the nozzles of the burner; there were no means of adjusting the relative proportions of gas and air entering the burner; and there was no arrangement by which one portion of the burner could be lighted and not another. So far as the design and ornamentation of the fire were concerned, the least said the better—the designer apparently as a rule making it his object to put as much meaningless ornament on to the fire as possible, and to create as many receptacles for dust as he could conveniently work into the pattern. The flue opening very frequently bore no obvious relation to the quantity of gas consumed in the fire; the same size flue opening being provided for a fire of small consumption as for one of large.

The Modern Fire.

By degrees, and in recent years by rapid strides, the gas-fire has been improved both in construction and in design. Without going chronologically through the stages of evolution, I will come at once to one of the many efficient and well-constructed gas-fires to be obtained to-day, at a considerably lower price than the badly-designed, inefficient fires of years ago, and call attention to various features which can be seen in the fires exhibited.

In regard to the burner, this is made so that only the centre jets need be alight if the whole heating force of the fire is not required. This is an infinitely better arrangement than the plan which previously had to be adopted of turning down the whole of the fire if it were desired to moderate the heat given out. This resulted in the whole of the fire looking dull and miserable, whereas now the centre of the fire can be kept fully aglow while the two ends are out altogether. Then the burner is provided with a skilfully

designed arrangement for adjusting the gas and air supplies to the burners, so that when a fire is installed, the burner can be adjusted accurately to give the very best results for the quality of gas supplied in the district in which it is fixed.

As to the fire-brick back, this is only so far from the front of the fire as to allow of one row of fire-clay "fuel" as it is so frequently, but erroneously, called—the term "radiants" being far more accurate. The result of this arrangement is that a very large proportion of the heat from the flame is either absorbed by the radiants within which the flame burns, or the fire-clay back which is very close behind them, instead of, as in the older type of fire, a considerable proportion of the heat being lost up the flue through cold air being drawn into the fire between the front of the fire-clay lumps and the fire-brick back, which, as we have seen, was some inches away. The fire-clay back to-day is also carefully designed so as to throw as much of the heat as possible which it has absorbed from the flames by radiation into the lower portion of the room.

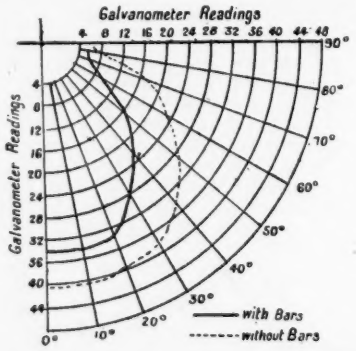
The Shallow Wide Fire.

By the adoption of the shallow type of fire, in which the greater part of the heat is immediately turned into radiant heat from either the loose radiants or the fixed back, with a resultant great economy of gas, it has become possible to adapt a much greater width of fire opening. For the same quantity of gas as, or even less than, was used in an old pattern fire with 10-inch opening, a glowing fire 16, 17, or even 21 inches wide can be secured. These wide fires are extremely useful for the heating of large rooms. The fire-clay radiants are now made in long pieces, one over each nozzle of the burner. These lengths are made to fit accurately and remain in position over the nozzle, so that the flame is given free access to the interior of the radiants without any disturbance of the flame. This is a very important point, as if the flame of a bunsen burner comes into contact with cold solid material too quickly, the inner cone of the burner, which consists of unignited gas, is broken, the flame is cooled, and imperfect combustion of the gas ensues, resulting in the production of a small quantity of carbon monoxide and the emission of an offensive smell, until the solid matter has become so hot as to have no seriously cooling effect.

The Need for Maintenance.

For this reason, every gas-fire should be periodically overhauled and adjusted by a workman who understands the job, with a view to seeing that the burner is clean and that no broken fire-clay, rubble from the chimney, or other solid matter has fallen on to the nozzles of the burners to interfere with the combustion of the flame. In the modern fire, the flame comes into contact with the interior of the fire-clay radiants in such a way as to ensure that a large proportion of its heat is absorbed by the fire-clay, while the flame is given proper space for its combustion.

The shape of the radiants is such, and the way in which they are fixed is so arranged, that they can be kept in position in the fire simply by a small strip of metal held in position by screws across the top of the radiants. Thus in the modern fire there is

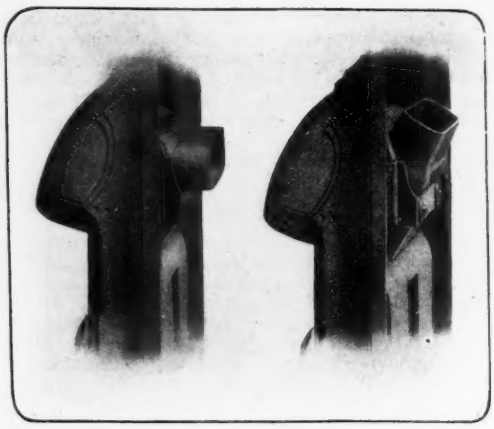


practically no ironwork in front of the fire-clay, whereas in the old pattern fires an iron grid of considerable surface was utilized to retain the loose lumps of radiating material, and, incidentally, materially reduced the radiating power of the fire.

Then we find that the shape of the flue and its size have been altered and varied so as to provide a sufficient but not too great an opening for the escape into the chimney of the products of combustion. Flues are now made so that they can be set at varying angles as may be necessary. We also find that there is sufficient space between the top of the radiants and the bottom of the canopy of the fire to secure that a quantity of air is drawn into the flue by the fire, with a resultant valuable ventilating effect upon the room, without the air being all drawn through the fire itself, with a consequent cooling effect upon the radiant bodies.

Abolishing the Air-Heating Chamber.

Further (and this is a most important point), it will be observed that the products of combustion now pass from the fire direct into the flue—there being no air-heating chamber in the top of the fire, which is only raised in temperature to a very moderate degree. This brings me back to the point from which I started to compare the gas-fire of to-day with that of ten years ago—the point at which I said that it was because the old-fashioned gas-fire did so much of its work by convection heating that it got the reputation of "drying" the air of a room.



It was the air-heating chamber of the old pattern fire (upon which makers relied for their efficiency) that was the cause of a great deal of the dislike which at one time was entertained by many people against gas heating, and gave rise to the idea to which I have referred—that gas-fires dried the air—with the result that one found, and still finds, in front of many gas-fires a bowl of water, which the user fondly believes corrects all the tendency of the gas-fire to "dry" the air of the room.

Do Gas-Fires Dry the Air?

What was the truth of the matter? Not that the gas-fire dried the air of the room, but that it heated the air of a room unduly, with the result, as we have seen, that the capacity of the air to absorb and retain moisture was likewise increased. This heated and thirsty air coming into contact with all the moist membranes of the eyes, mouth, and throat, and with the skin, of the occupants of the room, proceeded to satisfy its thirst for moisture, to the great discomfort of the persons whose bodies supplied the moisture required for the purpose. Now whereas the old type of fire gave out only some 25 to 30 per cent. of its heating power as radiation and another 25 to 30 per cent. in high-temperature convection, leaving a good 40 to 50 per cent. to go up the flue, the modern gas-fire sends out well over 50 per cent. of its heat in radiation, only about 20 per cent. of heat in the form of convection (and that at such a low temperature that the air of the room is only very gently warmed, never to such a degree as to cause physical discomfort), while 20 to 25 per cent. performs the necessary work of ventilation.

Again, the hot-air chamber in the old-fashioned fire also formed a very convenient receptacle for dust—a receptacle which it was impossible to clean out without taking the fire to pieces. This accumulation of dust was baked whenever the fire was alight, with the result that a most unpleasant stuffy smell was occasioned, similar to that experienced when hot-water pipes in channels under the floor are heated to a temperature that bakes and chars the dust and organic matters which constantly accumulate on them. This disagreeable and unhealthy state of things is entirely avoided in the modern type of gas-fire.

Artistic Designs.

It is hardly necessary to point out that the gas-fires produced in recent years are of designs which are calculated to harmonize with the decoration and furnishing of the best class of room. Ornamentation is either strictly in accordance with the characteristics of a given period of architecture and furniture, or is conspicuous by its absence—the fire depending entirely upon the lines on which it is designed for its pleasing, or at any rate inoffensive, effect. It should, moreover, be pointed out, for the information of those who have coal-grates of real artistic value, that gas-fires can also frequently be fitted into existing grates with success, though the heating efficiency is not always as high as in the self-contained type of fire; and care has to be taken to ensure a proper up-draught in the chimney.

Many thousands of fires are so fitted every year. A word of warning should, however, be uttered regarding that cheap and nasty make-shift of the local gas-fitter—a burner put into a grate with a lot of fire-clay piled upon it without any kind of arrangement in relation to the flames. Such abortions, with their incomplete combustion and waste of heat up the chimney, are true examples of the false economy of mere cheapness. All the improvements which I have described, and which mark an enormous advance in gas-fire construction, have resulted in a rapid increase in the adoption of gas heating by the cultured public. But they would have been largely discounted if great improvement had not also taken place in the skill and care with which gas-fires are installed and subsequently looked after.

Curing Smoky Chimneys.

Much prejudice has been created against gas heating in the past by the fact that in former days gas-fires were frequently fixed in rooms as a cure for a smoky fireplace, without any care being taken to ensure that the products of combustion were properly

carried up the chimney which had previously refused to carry away the smoke from the coal-fire. It is true that it is quite possible to cure a smoky fireplace by the installation of a gas-fire; but special steps are necessary to secure a satisfactory result. It is fortunate for the future of gas heating and for the comfort and satisfaction of the public that in recent years the gas undertakings of the country have in many, though not in all, cases, realized the necessity of carefully educating their fitters in the work of fixing gas-fires, and of subsequently overhauling and adjusting them when they have been in use for some time. The public, therefore, are now everywhere able to obtain well-designed, scientifically constructed gas-fires, skilfully fitted, and properly maintained, instead of ugly fires, badly constructed, badly fitted, and hopelessly neglected. This is the reason no doubt why the prejudice that at one time existed on the part of the medical profession against the use of gas for heating has rapidly diminished, and is steadily dying away.

Doctors and Gas Heating.

The medical profession in London are becoming enthusiastic supporters, instead of being active opponents, of, or indifferent to, the use of gas for heating. They recognize the enormous importance of gas heating in the sick room, whereby are secured the advantage of a strictly regulated and constant temperature, and the certainty that a fire can be maintained throughout the night without any attention and without any of the disturbance to the patient attendant upon the use of coal.

I could tell many interesting stories of the campaign which has been carried on in London during the past four years among the medical profession on the subject of gas heating; but I have already far exceeded the length of time that I desired to occupy. I would therefore only say that the practical testimony of the doctors of to-day is fully bearing out the pronouncement of the "Lancet" Commission twenty years ago, to the effect that "gas can be used for warming purposes efficiently without prejudice to health, provided that certain conditions are strictly adhered to."

Essential Conditions in Gas-Fire Construction.

It is interesting to note these conditions, and to see how completely they have been embodied in the modern gas-fire. The conditions laid down were:

1.—That it is desirable that the stove should afford radiant heat only.

2.—That for this purpose some form of clay fuel should be used.

3.—That attention should be given to the packing of the fuel so as to avoid undue clogging or impeding of the flow of the flames.

4.—That the stove should be supplied with separate burners with taps. [This has been adopted only partially, as it is found unnecessary to control each burner independently; it being sufficient to be able to control sections of burners.]

5.—That some means of controlling the supplies should be adopted. Governors or regulators are indicated. [This condition is met in the present day by the recommendation given to their consumers by most gas undertakings to have governors fixed on all gas-fires installed.]

6.—That a simple arrangement should be provided by which undue drying of the warm air may be avoided. This condition, the report stated, appears to be necessary. [Subsequent research and experience have proved this unnecessary, as the modern fire does not unduly warm the air.]

7.—That indestructible enamel should be used for covering the stove. Common paint, varnish, or ordinary enamel should be avoided. [This is invariably done.]

8.—That an efficient flue should in all cases be provided.

9.—That the burner should be, as far as possible, noiseless. [This condition, to which I have not previously referred, is fulfilled to a very great extent in all modern gas-fires, though absolute silence is not always achieved.]

I must leave to my next lecture the question of the use of gas-heated "radiators" and flueless stoves generally. These, so far as domestic heating is concerned, are chiefly to be recommended for the heating of halls and corridors, which adds materially to the comfort of the inmates, provided it is not overdone so as to create a uniform heat throughout the house, which would tend to reduce the amount of ventilation of the occupied rooms.

I propose in my second lecture to deal with the problem of fuel in the home as a whole—after briefly dealing with the gas appliances available for cooking and water heating—because the subject needs to be dealt with as a whole, and not merely in isolated details, if the advice to be given is to be of value. This evening I have endeavoured simply to describe the advances that have been made in gas-fires for the heating of the home, the reasons why prejudices formerly existed against this system of heating, and the steps that have, I think with much success, been taken to remove the grounds for these prejudices.

SUPPLY OF TAR, TAR OILS, AND PITCH.

The subject embraced in this title is dealt with in a long and interesting article by Mr. W. J. A. Butterfield, M.A., F.I.C., in the "Surveyor and Municipal and County Engineer" for the 28th ult.

The author begins by pointing out that attention has been drawn recently to schemes for the carbonization or dry distillation of coal of which a chief object is the production of fuel oils; and he says it has been asserted that the coal resources of the country, if properly developed and utilized, would suffice to render us in large measure independent of imported supplies of both petrol and petroleum fuel oils. The question of the supply of these oils, however, cannot be dissociated from that of the supply of coal tar and pitch, in which the road authorities of the country are now keenly interested. It should therefore, he considers, be of value to them to have before them a broad review of the sources of tar and their bearing on schemes for the production of fuel oils from coal. This review he provides in his article.

The supplies of coal tar available at the present time may be classified as coming from gas-works, coke-ovens, blast-furnaces, and producer plant; and the tar from each of these sources is dealt with in detail by the author. He gives a diagram showing the average London price of tar, pitch, and creosote oil during the past twenty years [the averages being deduced from figures given in the market reports contained in the "Journal" for the first week in March, June, September, and December in each year]; and also a table containing the figures of the estimated production of tar in the United Kingdom in the year 1910. Out of a total of 300 million gallons of tar produced, 163 millions came from gas-works, and only 90 millions from coke-ovens; while of the 973,700 tons of pitch obtainable from the total bulk of tar, 602,000 tons came from gas-works tar, and 230,000 tons from that produced by coke-ovens. In his remarks on the total production of tar, Mr. Butterfield refers to the schemes which have of late years attracted attention for the production of semi-coke for use as a domestic fuel in place of raw coal, with sulphate of ammonia and tar or oils as bye-products; and he says it must be remembered that the production of tar or oils by the destructive distillation of ordinary bituminous coal is commercially practicable "only if the bulk of the other products of the process—viz., coke, gas, and ammonia—can be disposed of at good prices or else utilized on the spot."

The author next gives a sketch of the early attempt at manufacturing tar or oil from coal—dealing at some length with the Earl of Dundonald's process, which was discovered in 1780, and failed to achieve commercial success. He then passes on to review the position of coal tar in the Nineteenth Century, discusses the relative position of tar and other products of the distillation of coal, and deals with the fluctuations in the prices of tar and pitch; and the article concludes with some observations on the low-temperature distillation of coal. Mr. Butterfield does not refer to the relative merits of the different systems in use, but merely indicates the objects that they have in common, and the conditions he believes to be essential to the commercial success of any scheme of low-temperature distillation. The conclusion he comes to is that, provided the tar and sulphate of ammonia can be sold at something approaching their present market values, and the semi-coke sold, at or near the point of production, for not less than 75 per cent. of the price payable at the same spot for the same weight of good coal, "there seems to be good reason to suppose that a scheme for the low-temperature distillation of coal could be worked on a paying basis in many localities, if the plant for the process were of good design." By "good design" he means that the plant must admit of coal being distilled to the required degree at no greater expenditure, on account of capital charges, power, and wages, than the corresponding expenditure on the carbonization of the same weight of coal in gas-works. He says it is "obvious that any plant which does not allow the coal to be charged into the distillation vessels and the semi-coke removed from them entirely by mechanical means is unlikely to fulfil this condition."

The Goldsmiths' Company, who in 1909 gave £50,000 towards the extension of the Engineering Department in the Central Technical College, have offered to pay the entire cost of the new building; the value of this new gift being approximately £37,000. The Company attach the condition that the portion of the capital belonging to the Imperial College of Science and Technology which will be thus set free shall be added to the endowment fund; the income being used for higher educational and research work.

M. Gerbault has called attention to a simple apparatus that has been devised for the purpose of detecting gas escapes automatically. It would be fixed to the ceiling quite independently of the gas-pipes, and consists of a bell operated by clockwork. The spring in the gear is kept out of action by means of an attachment which has a piece of spongy platinum in it. This begins to heat when gas comes in contact with it, and at about 80° C. the attachment is broken, the spring liberated, and the bell begins to ring. The "Ironmonger," from which the foregoing particulars were obtained, says that on trying the apparatus in a room of about 2100 cubic feet capacity, it was found that the bell was set in action in from 90 to 100 seconds after the breaking of a piece of rubber gas-tubing.

MANCHESTER STREET LIGHTING EXPERIMENTS.

At the Meeting of the Institution of Electrical Engineers last Thursday, a paper was read by Mr. S. L. Pearce and Mr. H. A. Ratcliff on the subject of the "Recent Developments in the Street Lighting of Manchester." Mr. Pearce is Chief Engineer of the Manchester Corporation Electricity Department. The paper, with diagrams, occupied 41 sides of a printed pamphlet. The authors first dealt with the early history of street lighting in the city; and, in passing, referred to the change of control from the Gas Committee to a Street Lighting Committee, composed of five members of the Gas Committee and an equal number of members of the Electricity Committee. Then followed an account of the experiments that preceded the Princess Street (high-pressure gas) and Portland Street (flame arc lamp) trial. With this trial, the paper chiefly dealt; but the authors stated that the lighting might be regarded as typical examples of modern street lighting by high-pressure gas-lamps and high-candle power flame arcs respectively. See reports by Messrs. Jacques Abady and Haydn Harrison, in "Journal," Vol. CXX., p. 344; also editorial comments.

The Gas Installation in Princess Street.

Four Keith high-pressure lamps were suspended in Princess Street at the same height above the roadway as the arc lamps—viz., 27 ft. 6 in. The distance between the lamps varied from 95 ft. 6 in. to 118 ft. 9 in.; but 106 ft. 6 in. may be taken as approximately the average. Each lamp contained three inverted burners, and clear globes were used. At normal pressure, each burner was rated at 1500-candle power, or a total of 4500-candle power for the complete lamp; but the maximum candle power obtained was only about half this figure.

As originally installed, the lamps were fitted with traversing and lowering gears; but these were apparently not successful, as the lamps were at a later date fixed permanently in position. The flexible gas supply tubing was also replaced by rigid galvanized gas-barrel.

Princess Street is 60 feet wide, and as the lamps were on an average only 106 ft. 6 in. apart, the resulting illumination was very good, and far superior to any previous example of high-pressure gas lighting in Manchester. Presumably in order to improve still further the maximum illuminating effect, but certainly not the uniform distribution of the light, the lamps have been lowered about a foot.

The Arc Lamps in Portland Street.

The central suspension system was chosen for the lighting of Portland Street, and certain predetermined "units" of light were erected at such calculated distances apart as to give the maximum illumination for the least capital expenditure.

In addition to low initial costs, the central lighting system has the following advantages, which appear to outweigh certain known disadvantages: (*a*) The distributing mains can all be kept to one side of the street. (*b*) No separate lighting standards are required on the street pavements, with consequent advantage to pedestrian traffic. (*c*) A more even illumination is obtained—in other words, the ratio of maximum to minimum illumination is less than with side lighting for a given amount of electrical power employed.

The traffic in Portland Street is of a very dense character all day long, and more especially between the hours 4 p.m. and 6.30 p.m., when the shipping warehouses are working at high pressure. It was therefore deemed advisable to aim for a high standard of minimum illumination—viz., something of the order of 0·5 foot-candle.

The length of Portland Street is 1751 feet, and its width 66 feet. Sixteen 550-watt lamps, working four in series on the 200-volt mains, have been erected. Owing to the positions at which certain important side streets intersect the main street, the distance between the lamps varies from 114 feet to 124 feet.

Eight of the 16 lamps are run on an all-night circuit, and the remaining eight are switched off at 11 p.m. The lamps are so arranged that when all sixteen are burning the lighting is balanced across the three-wire distributing mains; but after 11 p.m. the remaining eight lamps are connected up to one side of the system only.

With six exceptions, which called for the use of the tramway side poles with extended arms, the arc lamps were suspended 28 feet above the level of the street, by means of two wrought-iron straps, from two steel wires of $\frac{5}{16}$ inch diameter placed 14 inches apart, one above the other in a vertical plane. Under these conditions, the swinging of the span wires is largely counteracted.

The lamps are fixtures, in so far as no provision has been made for lowering or drawing them to the side of the street. All trimming has, therefore, to be done from a tower waggon. This decision was come to after carefully considering the extra expense and complication involved in arranging for lowering gear, and also with due regard to the type of lamp selected, the hours of burning, and the local conditions. The lamps themselves are of the magazine type; and the actual hours of burning average 70, but it is usual to allow only 65. The first results obtained with the arc lamps were not considered altogether satisfactory; the shadows under the lamps, thrown by the ash-trays, were most pronounced, as was also the series of concentric rings on the surface of the roadway. As fitted with clear inner and opalescent outer globes, the lamps gave a maximum candle power of 2250 on the 20° ray. This was substantially lower than the result anticipated.

Photometric tests showed that the polar curve of the lamps with the particular inner and outer globes used did not meet the necessary requirements; and the resulting distribution of the light was very unequal. The shadows and concentric rings were practically eliminated by the use of slightly opalescent outer globes; but the efficiency of the lamps was impaired to a very appreciable extent, and the distribution of light was rather worse than before—the change from the dark zone midway between the lamps to the bright zone adjacent to the lamps being very pronounced.

It is immediately apparent, from an inspection of the polar curves, that neither the clear nor the opalescent outer globes were suited to the particular conditions obtaining in the lamps and the desired distribution of light. Certain modifications were therefore made to the lamps. To begin with, the height of the lamps was lowered from 28 feet to 27 ft. 6 in., with a view to masking certain shadows of the trolley-wires thrown on the ground. The most important alteration, however, was the outcome of a suggestion made to the authors by the Superintendent of the Street Lighting Department, that while the lamps were undoubtedly giving their rated candle power, yet, owing to the particular design of the outer opalescent globes and spinnings, practically all the rays from the horizontal to the 18° angle below the horizontal were entirely blotted out.

The construction of the spinnings supporting the globes, and the shape of the outer globes, were therefore considered to be largely responsible for the unsatisfactory distribution; and it was decided to modify the construction of the spinnings in such a way as to result practically in a lowering of the arc a distance of $\frac{5}{8}$ inch, and also to use another type of outer globe, in which there was less interference with the direct transmission of the light rays emanating in the neighbourhood of 20° below the horizontal.

The alterations resulted in a substantial increase in the candle power emitted between the angles of 10° and 20°; the maximum ray attaining 3600-candle power at an angle of 23°. One objectionable feature remained, however—viz., the deep shadow vertically beneath the lamp. But the efforts to get rid of this were ultimately successful.

Reports of the Two Systems.

In the early part of 1912, the Manchester Corporation called in Mr. Jacques Abady and Mr. Haydn Harrison to report on the two systems of street illumination as carried out in Princess Street and Portland Street respectively. The results were to be expressed on an "equal basis of cost and illumination."

There followed in the paper an account of the photometric work undertaken prior to the advent of the two experts. In the course of this, the authors referred to the difficulty of choosing a suitable height for photometric measurements, mentioning the suggested international standard height of 3 ft. 3 in. Many of their measurements were taken at 5 feet; but for the purposes of comparison they were converted to their corresponding values on the horizontal plane of 3 ft. 3 in. above ground level. Another incidental point made was that the results of street photometric tests are very frequently questioned, and gas authorities invariably dispute their accuracy. It is therefore advisable to consider briefly the limits of accuracy desirable and obtainable in practice. The gauge or conception of the intensity of illumination by the human eye follows a logarithmic law; in other words, it is only the percentage variation in the intensity of illumination which is noticeable. Consequently, small variations are of no importance; and it is even very doubtful whether it would be possible, without the aid of photometric apparatus, to detect a difference in the intensity of illumination in a street within a range of (say) 10 per cent. A consistently maintained degree of accuracy within a limit of 5 per cent. is therefore all that is necessary for ordinary street work; and, in fact, such a limit is recognized as sufficiently close by most of the authorities on photometric work. It is very questionable whether it would be possible to guarantee any street photometric measurements as correct within a limit of error of less than 3 per cent.; but in any case the complications and extra work involved would be quite beyond the possibilities of tests conducted on anything approaching a commercial scale.

General Comparisons between the Lighting in Portland Street and Princess Street.

Any comparison of the Portland Street and Princess Street lighting, other than on an "equal basis of cost and illumination," requires to be very unbiased, since there is much to be said in favour of both systems.

The gas-lamps give a much steadier light than the arc lamps,

though the difference is not very noticeable to a casual observer, or even to a keen observer. But it is very noticeable when making measurements with a "flicker" photometer; and the severe eye-strain incidental to the use of such a photometer is in consequence considerably reduced. Unfortunately, though the gas-lamps give a steadier light, their candle power varies very considerably from day to day. The candle power of a particular lamp may fall at least 50 per cent. before the mantles are renewed, unless it is arranged to change only one mantle at a time—thus spreading the complete change over a fairly long period. The candle power of the arc lamps may vary quite appreciably within a few minutes; but provided that the same make of carbons is used, the average candle power at any particular angle will not change to any extent from day to day, if the line voltage is reasonably constant.

A very important feature directly affecting the comfort of the general public is the absence or otherwise of glare. Glare is purely a physiological effect, and is apparently dependent upon the intrinsic brilliancy of the light-source and the angle of incidence of the light-rays received by the eye. Obviously, therefore, the larger the surface of the light source in proportion to the total amount of light emitted, the lower the intrinsic brilliancy, and the less the effect of glare. In this respect, the three-burner high-pressure gas-lamps have an advantage over the flame arc lamps with clear inner and outer globes. The use of clear outer globes with flame arc lamps is, in fact, hardly advisable from the point of view of scientific lighting, since any form of lighting which is productive of eye-strain is essentially unscientific, and is certainly unsatisfactory.

Two noticeable features in Princess Street are the comparative softness of the shadows of objects cast on the ground, and the absence of a pronounced dark horizontal zone in line with the reflectors. The first result is undoubtedly due in great measure to the fairly large triple light-source, which has the effect of shading-off the edges of shadows; and the absence of a dark zone in line with the reflectors is no doubt due partly to the fact that the source of light is well below the reflector, and partly to the reflection from the inner surface of the large globes.

The shadows cast by the flame arc lamps when burning with clear inner and outer globes are very intense; and there is no appreciable shading of the edges. Consequently, it is possible to confuse shadows with actual objects. The smallness of the light-source—or, in other words, the high intrinsic brilliancy—and the fact that the arc is well up under the reflector, is no doubt the cause of the objectionable horizontal dark zone noticeable in cases where reflectors are used. The Portland Street light has a much warmer and more cheerful effect than the comparatively cold light in Princess Street.

Purely from the point of view of illuminating effect, there is much to be said in favour of both systems; but the electric lighting system possesses all the practical advantages, a few of the more important of which are: (*a*) Lower cost. (*b*) Simplicity of switching operations, and possibility of dispensing with lamp-lighters. (*c*) Flexibility and ease of erection. (*d*) Lamps not affected by vibration when suspended from traction poles. (*e*) Possibility of reliable check or running costs—(*i.e.*, current consumption and carbons. (*f*) Negligible leakage. (*g*) Absence of globe breakages due to heating, &c.

All these advantages are absent in the case of the high-pressure gas system, and in contrast may be mentioned the disadvantages incidental to its use: (*a*) Extensive and highly dangerous leakage of high-pressure gas. (*b*) The detrimental effect of a foggy or heavily smoke-laden atmosphere on the mantles, resulting in a serious diminution of candle power just at a time when it is most required. (*c*) Partial and occasionally complete failure in frosty weather.

Confirmation of the Portland Street Results as Furnished by the Reports of the Experts.

Reference has been made to the results of the first photometric tests in Portland Street; and consequently the value of the subsequent experimental work is clearly indicated by the successful results now obtained. Portland Street is a most unsatisfactory thoroughfare to illuminate, from the nature of the buildings and the absence of any appreciable amount of reflection. Nevertheless, the present lighting is probably as good an example as will be found elsewhere of uniform street lighting with a high average intensity of illumination on the horizontal plane, and a reasonable absence of glare. The minimum intensity of the illumination on a horizontal plane 3 ft. 3 in. above the ground is, with unimportant exceptions, 0·5 foot-candle, and the ratio of maximum to minimum illumination in the centre of the road is 3·75. The ratio of the maximum to the minimum illumination on the horizontal plane may conveniently be referred to as the "variation factor."

When carefully analyzed, the experts' reports very closely confirm the values of candle power and illumination claimed by the Corporation Electricity Department as a result of the tests made by their own staff. Apart from actual values, the proportionality of Mr. Abady's figures for the illumination of Portland Street and Princess Street is in fairly complete agreement both with the Electricity Department's and Mr. Harrison's results; and his values for the candle powers of the Princess Street lamps provide important confirmation, not only of the Electricity Department's tests, but also of the fact that the lamps were not giving anything like the candle power claimed by the manufacturers. This result is both interesting and important, for it has always been the experience of the authors that gas-lamps give substantially lower candle powers than the values claimed by the manufacturers. This is evident from the figures given in Table I.

Table I.

Description of Lamp.	Year of Test.	Rated Candle Power.	Actual Maximum Candle Power (Average Results).
Keith, three-burner high-pressure gas	1912	4500	2300
Keith, two-burner high-pressure gas	1912	3000	1630
Keith, single burner high-pressure gas	1912	1500	725
Welsbach-Kern, twin-burner	1907	1200	655
Sugg's "Belgravia"	1907	1800	1025
Lucas "Thermopile"	1907	1250	765
Intensified gas, Sackville Street	1904	1000	525

Relative Costs of the Two Systems.

The totals for "fixed" and "running" costs respectively are shown in an appendix; and the question of how these should be applied to the special case of a street-lighting load may give rise to some difference of opinion. There are three possible methods:—

1.—To divide the actual totals of the "fixed" and "running" charges respectively by the total maximum demand on the undertaking and the total units sold for all purposes.
2.—After arriving at the totals for the "fixed" and "running" charges, to deduct therefrom the traction costs (ascertained in the manner laid down in the recent model report of the Municipal Tramways Association and the Incorporated Municipal Electrical Association); and then to divide the remainders by the respective totals for the maximum demand and the number of units sold for lighting and power.
3.—As in (2), but to differentiate further between lighting and power supplies.

The authors consider that the course outlined under (3) is the correct one. The resultant figures are £6·133 per kilowatt of demand, *plus* 0·232d. per unit metered. Applying these values as shown in an appendix, the cost of the current for the 11 o'clock and for the all-night lamps respectively comes to 0·97d. and 0·6d. per unit. The cost of uncompressed gas per 1000 cubic feet (as deduced from the published accounts of the Gas Department) is stated by the gas authorities to be 12·69d., and the corresponding figure for compressed gas is 13·89d.

For the purpose of ready comparison, the following particulars of the lighting in Princess Street and Portland Street are extracted from Mr. Haydn Harrison's report. In order to make the figures strictly comparable, the Portland Street lamps are assumed to be all switched out at 11 p.m.

—	Princess Street. High-Pressure Gas.	Portland Street. Arcs.
Candle power of lamps	1750	2970
Number of lamps to the mile	49·34	43·6
Running costs per lamp per hour	1·5d.	0·7d.
Capital cost per mile of street	£2537	£1569
Running cost per 1000 c.p. hours	0·857d.	0·236d.
Cost per annum per mile, equal illumination	£675	£254
Minimum illumination, basis of comparison	0·39 ft.-candle	0·5 ft.-candle
Cost per mile of street per annum (up to 11 o'clock) at above illumination	£617	£254

The Lighting in Mosley Street, St. Peter's Square, Albert Square, and Piccadilly.

In regard to the high-pressure gas lighting in Mosley Street, it is a very poor display compared with the arc lighting. It is also a very poor display of high-pressure gas lighting. An illumination on the horizontal plane 5 feet above the ground-level equal to 0·5 foot-candle is only obtained up to a distance of 22 feet from the base of the lamp posts, and the minimum midway between the posts is only 0·07 foot-candle; the "variation factor" being as high as 43.

St. Peter's Square is distinctly a better example of high-pressure gas lighting, and compares favourably with the flame arc lighting in Albert Square. The illumination on a horizontal plane 5 feet above the ground-level is maintained at a sufficiently high value, and is equal to 0·5 foot-candle in all parts where there is any great amount of traffic. The 500-watt lamps in Albert Square are fitted with slightly opalescent globes, and are mounted on poles at a height of 22 ft. 8 in. above the ground. The illumination is fairly uniform.

The average horizontal illumination in Piccadilly is well over 1 foot-candle; and in no part where there is any appreciable amount of traffic is it less than 0·5 foot-candle. The roadway is lighted by means of twelve 500 and four 550 watt lamps, fitted with clear inner and outer globes, and fixed on the tramway standards at a height of about 27 ft. 6 in. above the ground. In addition, there are also ten 450-watt lamps on the esplanade.

These lamps have opalescent bowl-shaped globes. They are suspended from swan-necked pole-brackets at a height of 18 ft. 6 in.

The Physiological Problem—Colour Differences.

In a discussion of this matter, the authors said it must be admitted that there is a difference in colour between the light from the flame arc lamps and that from the high-pressure gas-lamps; and it is therefore of interest to consider the probable effect of such difference. If the well-known "Purkinje" effect may be taken as a guide, the arc lamps should give a superior illumination in their immediate vicinity, and the gas-lamps a superior effect at a distance. The point of equality is probably in the neighbourhood of an intensity of normal illumination, equal to about 1 foot-candle.

Visual observations confirmed the excellent carrying power of the light from the gas-lamps; and it was therefore decided to obtain definite comparisons by means of the luminometer. These tests showed that the flame arc lamps were quite the equal of the high-pressure gas-lamps, so far as the resulting illumination at a distance was concerned; but this was probably to a certain extent due to the higher candle power of the arc lamps at the angles concerned. These tests and observations (Table II.) refer to clear weather. There is no question as to the superior penetrating power of the rays from the arc lamps in foggy weather.

Table II.

Sizes of Type.	Maximum Distance at which Distinctly Readable.	
	High-Pressure Gas.	Flame Arcs.
Large	339·0 ft.	371·5 ft.
Medium	265·0 ,,	313·0 ,,
Small	212·5 ,,	242·0 ,,

All figures are the average of not less than six sets of observations taken on different nights.

Globes, Diffusers, and Reflectors.

The authors then described the very considerable amount of testing and experimental work undertaken in order to discover, if possible, the most satisfactory type of outer and inner globe for use with the arc lamps under the conditions obtaining in Portland Street, and to comply with the following requirements: (1) Reasonably uniform illumination. (2) Absence of glare. (3) Moderate cost of globes. (4) Light distribution not affected by slight alteration in the position of the arc. (5) Maximum candle power approximately between the 20° and 25° rays below the horizontal. As previously mentioned, the light distribution with the original globes was anything but satisfactory; for, in addition to most pronounced shadows under the lamps, the general illumination was very unequal. The glare was also most objectionable, and must have caused a considerable amount of personal discomfort to passengers on the open tops of tramcars. The first attempt to overcome these defects was by the use of opalescent outer globes of the same shape as the clear globes. The result was a distinct diminution of the shadows under the lamps, and the complete disappearance of the concentric rings. But, unfortunately, the light distribution was considerably reduced, and the dark gaps midway between the lamps were very noticeable.

Various types of dioptric and inner diffusing globes were then tried, but without appreciable success. This lack of success was, no doubt, due in a great measure to the position of the arc and the shape of the original outer globes. It was not until the type of outer globe now in use [slightly obscured at the bottom] had been adopted that any headway was made with the various attempts to improve the light distribution. The authors' tests seem to demonstrate very clearly a rather objectionable feature of dioptric globes—namely, the strongly defined optical centre, in consequence of which the light distribution is considerably distorted if there is any appreciable change in the arc position. By the use of globes slightly obscured at the bottom, there was a great improvement in the curve of illumination on the horizontal plane; and the glare was appreciably reduced.

Experiments were also made in equipping the lamps with enamelled iron reflectors of various shapes; but it can hardly be said that the results were very successful—at any rate from the point of view of the distribution of the light. Reflectors were really tried in order to remove the shadows under the lamps cast by the ash-trays. But for this purpose they were only partially successful; and the resulting distortion of the polar curve was very unsatisfactory. One objection to the use of reflectors is the dark shadows cast above an angle of about 80° to the vertical, as a result of which the blackness of the buildings and the darkness above the lamps is very much intensified. This is particularly noticeable in foggy weather.

The "man in the street" probably bases his opinion of the respective merits of rival schemes of lighting upon the relative intensity and extent of the illumination. Consequently, there is no doubt that it is a distinct advantage to illuminate as large an area of buildings as possible, provided always that it can be done without a reduction of the light flux in a more useful direction. If the elimination of shadows can therefore be effected by more legitimate means, there is no advantage to be gained by the use of reflectors. It is very evident, from the results, that the most satisfactory curves of light distribution are obtained either with suitably frosted outer globes, or with dioptric inner globes used in conjunction with partially opalescent outer globes. There is little to choose between the two methods on the score of light distribution. The dioptric globes undoubtedly have a slight advantage in this respect; but when it comes to the consideration of general advantages and disadvantages, there is much to be said in favour of the partially frosted outer globes.

Conclusions from the Tests.

The numerous tests referred to in the paper have at least vindicated the lighting of city streets by means of flame arc lamps, not only on the dual basis of equal cost and illumination, but also on the ground of light distribution.

As there is a substantial difference between the cost of the flame arcs and the high-pressure gas-lamps for the same minimum illumination, it would be possible to improve the arc lighting, if considered desirable, by reducing the distances between lamps in the case of future extensions. If fixed at the present height, and

Table III.

Description of Lamp.	Where Situated.	Height Above Ground Level.	Maximum Candle Power. Average Results.	Illuminations on Horizontal Planes in Foot-Candles.			Height of Measuring Plane.	Variation of Factor.	
				Maximum at Centre of Road.	Minimum at			Centre of Road.	Maximum.
					Centre of Road.	Building-line.			
		Ft. In.					Ft. In.		
550-watt flame arcs, original globes. Outer globe opalescent	Portland Street	27 6	2250	3·14	0·370	0·280	5 0	8·50	11·20
550-watt flame arcs. New type inner and outer globes. Experimental obscuration	Portland Street	27 6	3660	2·53	0·675	0·500	3 3	3·75	5·06
550-watt flame arcs. Final graded frosting	Portland Street	27 6	3560	2·50 2·00	0·670 0·670	0·500 0·500	3 3 ground level	3·75 3·00	5·00 4·00
500-watt flame arcs. Opalescent outer globes	Albert Square	22 8	1910	4·94	0·150	..	5 0	32·90	..
550-watt flame arcs. Clear inner and outer globes	Piccadilly	25 6	3580	5·95	0·760	0·500	5 0	7·85	11·90
Keith 3-burner, high-pressure gas	Princess Street	26 6	2300	2·23	0·575	0·400	3 3	3·88	5·58
Keith single-burner, high-pressure gas.	St. Peter's Square	17 0	725	(a) 2·45	0 180	0·120	5 0	13·6	20·4
Keith single-burner, high-pressure gas.	Mosley Street	15 6	725	(a) 3·00	0·070	0·055	5 0	43·00	..

(a) These values are the maxima, obtained approximately 5 feet from the posts, and not at the centre of the road.

100 feet apart, the minimum illumination would be not less than 0·75 foot-candle.

No attempt has been made to obtain perfectly uniform illumination, since it is very doubtful whether such a scheme would be desirable, even if possible. A variation factor of 3·75 is not excessive, if the change is fairly gradual; and in this respect partially frosted globes give results quite as favourable as the dioptric ones.

DISCUSSION.

Mr. A. H. Seabrook (Chief Electrical Engineer of the Borough of Marylebone), speaking on behalf of those in London who, he remarked, had been very much disturbed during the past twelve or eighteen months on account of the progress made with gas in street lighting, said that if such a paper as the one just submitted, with its valuable tests and records, had existed previously, there would have been nothing like the amount of success gas had obtained. He fully agreed with the use of centrally-hung lamps, but criticized the paper on the question of lowering gear or tower waggons. Mr. Pearce did not seem to attach much importance to the point of being able to lower lamps, as he used tower waggons. But the lowering of lamps was certainly an assistance in saving cost in trimming, and also in dealing with faults, as the lamps could be lowered regardless of the congestion of traffic. During

the past eighteen months, the Oxford Street lamps had been changed from tower-waggon trimming to lowering; and the cost of the gear had been practically wiped-out by the saving of labour, apart from the more frequent attention to faults. Mr. Pearce's figure of 0·2d. for carbons was interesting, because, in order to keep down the cost for flame-arc carbons in Oxford Street, he thought he would adopt a carbon which cost 0·16d. But the result was quite unsatisfactory, and showed that cheapness was often a dangerous economy in street lighting. He had now gone back to a carbon which brought his costs under this head to the same as those of Mr. Pearce. Street lighting was one of the greatest advertising possibilities available for an electricity supply undertaking; and everything should be done in the best possible way. He asked Mr. Pearce for more information as to the globes, with which he seemed to have had such success after a great deal of trouble. There was an interesting point in connection with Mr. Pearce's 0·97d. for half-night and 0·6d. for all-night lighting, which were not very low figures; and by taking the maximum lighting load, which he thought was the more accurate basis, it meant that anybody who was very hard pressed by gas for street lighting had a considerable margin on these profits for making a still further cut-price.

Mr. Haydn T. Harrison, in congratulating the authors, said that a good deal of similar work had been carried out by the City of London Company, but the detailed results had not been published. The point that would interest all electrical engineers in this paper was the one that high-pressure gas in this particular instance was successfully shown to be out-of-court. It was, of course, known that the high-pressure gas in the experiments was not up to the standard that could have been obtained; and it was only fair to say that better lighting was being done with high-pressure gas in Westminster than was shown by the Manchester Gas Department. He believed he was at liberty to say that the reason of it was that in Manchester they were working a lower pressure gas than in London; but if they had used the same pressure as in London, they would have saturated the subsoil with so much gas that there would have been objections from all directions. This simply meant the difference between 27-candle power per cubic foot of gas and nearly 50-candle power per cubic foot, as was being obtained from the lamps in Regent Street, Victoria Street, &c. The reason why they were able to get this extra efficiency in London was because the gas people had taken the same care and precautions in anticipating their street lighting load that Mr. Pearce and Mr. Ratcliff had taken in anticipating theirs with electric light. If the readers of the paper had simply slung up a series of arc lamps in the streets, the report by Mr. Abady would have been very successful against his own, which, fortunately, was able to show that electric light could do better. It was through the care the Manchester Electric Light Department took in using these lamps with a certain amount of common-sense, and telling the makers of the lamps they must have what they wanted, that the results obtained had been possible. In Manchester, they had done a lot of work which had not been gone through in other places; and, in his opinion, the putting-up of flame arc lamps indiscriminately was doing more harm than anything else to public lighting from the electrical point of view. As instancing this sort of thing, he mentioned that a certain circular had been sent round by one of the many associations connected with the electrical industry, in which in one part it was stated that anything from 2500 to 5000 candle power could be obtained from flame arc lamps. Yet, when the circular gave an exact example, it had to admit that they were only getting 1300 to 1700 candle power. This was useless, and was one of the things which the Institution had already considered carefully, and he hoped would soon deal with from the point of view of the standard street lighting specification. Flame arc lighting was a very interesting question; and he had had an opportunity of seeing figures recently published by Dr. Bloch, who was one of the most eminent authorities in Germany on this subject. Dr. Bloch had put in his book that, with high-pressure gas lighting, at the present moment it was possible to obtain 25·5 candles per cubic foot horizontally. For the interest of those who treated the matter scientifically, he might say that this was 18 spherical and 16 mean hemispherical candles. Municipal engineers were frequently told that, in order to successfully compete with gas, they would need to have regard to the figure of 50 candles per cubic foot. Dr. Bloch had now shown that this was not the case; and it could be taken that the effective candle power useful for street lighting purposes by high-pressure gas-lamps did not generally exceed 30 candles per cubic foot. It was interesting to note, in this connection, that Mr. Abady's tests, which were carried out by a method absolutely different from his own, gave a mean 27 candles per cubic foot with high-pressure gas; and Dr. Bloch's results, published since Mr. Abady's report, showed that this was not very far wrong. Here there were two independent people testing in a town in England getting an average of 27 candles; while a test carried out in Germany under quite different conditions also showed a similar average, and that, at the present moment, was the average to be thought of. At the same time, it should not be assumed by the electrical industry that this was the maximum that might be given by high-pressure gas, because there were possibilities in this as well as in electric lighting. As regarded the degree of illumination mentioned in the paper, the authors gave a minimum of 0·5 foot-candle horizontal. When the results of the Institution tests were published, it would be seen that this was a high minimum; and it could not be reckoned to apply except in towns of such importance as Manchester. Manchester was peculiar in its streets, inasmuch as the buildings were practically black, and there was nothing to help in the way of reflection in street lighting. As to intrinsic brilliancy, if they made a comparison between arc lighting and high-pressure gas, many people would say that the effect on the eyes from arc lamps was not so pleasing as the effect on the eyes from gas; and this was probably put down to the arc lamps having a higher intrinsic brilliancy. He had worked it out in the only scientifically-known way—namely, the candles per square inch or candles per square centimetre—and as far as this was concerned, with high-pressure gas-lamps, such as in Regent Street, giving nearly 3000-candle power in 9 square inches, the intrinsic brilliancy of the light source was a great deal higher than it was with the flame arc lamps, which were in globes exactly similar to those used in Manchester. The globes employed in Manchester were rather curious, and gave a different degree of density from the base to the horizontal; and therefore it was a little difficult to give a figure of intrinsic brilliancy. Certainly, it was a great deal higher than the intrinsic brilliancy of the average arc lamp, which usually absorbed 22 to 25 per cent. of the light in its globe; but nevertheless, as far as intrinsic brilliancy was concerned, electric light in the case of Manchester, even from the scientific point of view, would, he was perfectly convinced, have the advantage.

Professor Schwartz dealt with the question of street photometers. On the point of an international standard height for measurement—viz., 1 metre above the street surface, at which all illumination measurements could be taken—he agreed very heartily with the authors that there seemed to be no real reason why this should have been selected. It was a very inconvenient height for making experiments; and he agreed again with the authors that a height of 1½ metres would be a more convenient plane, and would represent approximately the average eye height. The experiments in Portland Street and Princess Street, taken on a plane 5 feet above the street surface, gave results slightly higher than the authors', both for gas and arc lamps; but they confirmed the general relationship between the two illuminants. They also confirmed the great variation in the candle power of the high-pressure gas-lamps found by the authors in Mosley Street. For instance, four high-pressure gas-lamps on a 5-feet plane showed a maximum illumination of 2·55, 3·4, 4·55, and 6·5 foot-candles from each lamp respectively. The authors had referred to the question of glare. In the average case, glare was caused by light between the angles of 60° and 80° with the vertical. The authors were to be heartily congratulated on their diffusing arrangements and the absence of glare, which was cheaply purchased by the loss of a little light.

Mr. Frank Bailey (the Chief Engineer to the City of London Electric Lighting Company) thought it would have been better to have avoided all the difficulties which seemed to have been encountered in the streets of Manchester, and to have tested the lamps thoroughly first of all indoors, and then to have realized success in the streets immediately the lamps were placed in position. The paper rather gave the impression that there was something new in arc lighting, and that there was something unknown about flame arc lighting—some untold difficulties and disadvantages that required expert assistance to overcome. This was not the case. Mr. Harrison had been good enough to refer to the work which had been done by the City of London Electric Lighting Company, and had stated that the results had not been published. He did not agree. The City of London Company had always published their results as soon as they were fit to be published. What they did not publish was a long history of disappointment and failure, which would have discouraged any mortal man; and it was neither necessary nor wise to publish these failures. Reference had been made in the paper to the grading of the opalescence of globes; but was this necessary? It ought not to be. The thing they should all try to avoid was to interfere in any way with the globe, but to preserve it as long as possible in the state in which it was received from the makers. It was the greatest difficulty in the world to maintain globes in their original condition for more than a few days in the ordinary city atmosphere; and therefore they should not start by treating the globes in a manner which only assisted trouble from dirt. With regard to dioptric globes, he had had some experience of them, but did not know the type with which the authors had experimented. From the methods they had adopted in order to get the extraordinary results mentioned in the paper, it seemed that something must have been very wrong. There were a great many dioptric globes in existence, and he should be sorry to think that this particular one was likely to be used indefinitely in the particular form referred to. As to lowering gear, in his opinion there could be no question at all as to its practical advantages.

Mr. Kenelm Edgcumbe (Messrs. Everett, Edgcumbe, and Co.), speaking on the question of the metre height for street tests, said there was a little more in it than the fact that it was a convenient unit. The paper did not strike him as being enthusiastic over the "flicker" photometer; and he heartily agreed with the authors in this. For street work, he had never been in favour of the "flicker" photometer. Finally, he suggested the desirability of arriving at some figures as representing illumination in foot-candles per yard of street, in order to arrive at the cost, because it was extremely difficult, as far as he could see from the paper, to arrive at any definite or concrete figure. They knew that the arc lamp was better than gas—though, no doubt, gas people had some opinions about this. But the difficulty was to arrive at a comparative figure; and it occurred to him that, if they took the

average illumination over the length between two lamps, and multiplied it by the distance, this would give what might be called "foot-candle-yards." The average foot-candle-yards multiplied by the distance would give some sort of figure corresponding to the horse power of an engine. This figure, multiplied by the hours of running, would give a constant from which could be told what the value of a particular lighting installation was; and a very good comparative figure this would be. Working out this idea roughly, he calculated that (from one of the figures given in the paper) gas was about 47 foot-candle-yards, and electric light 62 foot-candle-yards. Taking the figures of £5 15s. for 2000 hours' burning for gas and £3 5s. for electric light—he was not sure whether he had taken the right figures in the paper—this worked out to 2s. 6d. per foot-candle-yard for gas and 1s. for electricity per 1000 hours' burning.

Professor J. T. Morris (East London Technical College) said there were certain things in connection with gas upon which he should like further information, if the authors could give it to him. It was stated that the detrimental effect of fog or heavily smoke-laden atmosphere on the mantles resulted in a serious diminution of candle power. Was this due to the fact that carbon was deposited on the mantle, and so diminished its efficiency as a light-giving source? Did the mantle look black, or was it a defect which burned off after a time; and what was the magnitude of the defect? Was it a thing which dropped the candle power 5 per cent. or 50 per cent.? Turning to the question of the efficiency of gas-lamps, it was regrettable that the Manchester gas-lamps were undoubtedly not working at the best efficiency they could have worked at; but, as many people had stated, high-pressure gas-lamps at the present time, as a rule, did not give their guaranteed candle power. He had examined most carefully the reports of Mr. Harrison and Mr. Abady in connection with this; and their statements were to a certain extent in conflict. But reading between the lines, one was able to come to the conclusion that the average high-pressure lamp gave a candle power which was deficient by something of the order of 25 per cent., and, in a great many cases, as much as 50 per cent. He, personally, was interested in this, because some years ago he made a series of tests in his laboratory on high-pressure gas-lamps, and the figures he obtained were almost exactly corroborated by the tests in the paper. Table I. was most eloquent on this matter, because it showed a lamp which was said to give 4500-candle power giving only 2300 candles; and all the way down the table the figures were practically half, or a little more than half. Therefore it was exceedingly important that the gas people should see that when they supplied their lamps they were put up in such a way that the candle power yielded should be that which they believed could be got out of them. As far as he could gather, it seemed more difficult to get the rated candle power out of high-pressure gas-lamps than out of arc lamps. This was a matter which high-pressure gas people should attend to, because he personally wished to see fair open competition; and he expected everybody else did. He would like to know what was the calorific value of the gas in Manchester. Reverting to the effect of a foggy atmosphere as distinct from that of fog on the mantle, he gathered from the statement in the paper that the authors were perfectly distinct that the electric lamp was better than high-pressure gas in foggy weather. If they had measurements by means of which they could corroborate this statement, these would be most valuable, because electrical engineers often had to face the statement that high-pressure gas had much better penetrating power in fogs than the electric arc; and he knew of cases where high-pressure gas had been put in in foggy districts simply because this statement had been believed. Therefore it would be most valuable if one could have some figures available to show that the reverse was the real truth. For the present, at any rate, they had the authors' opinion on the question. With regard to costs, he had worked out, in the form of a short table, the costs of the various parts which might go to make up the total expenditure in the case of both electricity and gas, with the idea of seeing in which direction improvement seemed the most hopeful; and he found that, in the case of electricity, from 60 to 65 per cent. of the cost was for current, while in that of gas, 80 per cent. was for the cost of gas used. With regard to trimming and maintenance, the arc lamp was much better, being 7 to 8 per cent. against 13 per cent. for gas, and finally carbons in the case of the arc lamp accounted for 28 to 30 per cent. of the cost; while for gas, only 7 per cent. could be attributed to mantles. But it must be borne in mind that this 7 per cent. referred to lamps which gave half the proper candle power, and it was very obvious that as the candle power was brought up, the life of the mantles would be shortened very largely. But unfortunately they could not get figures for mantles at the present time which corresponded to the lamps giving their full candle power.

Mr. J. S. Dow (Assistant Hon. Sec. Illuminating Engineering Society), speaking on the question of glare, said that the experience of most people was that the rays which caused the most trouble are those which come at the small angles from the horizontal. However, these were the very ones required to get uniform illumination, and the advocates of uniform illumination were in a difficulty, especially in the matter of street lamps, because it they made the glare small, the illumination midway between the lamps was also necessarily small. He, however, was an advocate of even illumination. With regard to the use of diffusing globes, these, as a rule, did not affect the light to any great extent. Speaking on the question of the height of measurements, he supported the metre—first, because it had been recommended by an International Committee on Nomenclature, and, secondly, because it was the height always used for indoor measurements.

Mr. S. L. Pearce, in reply, dealt briefly with a few of the points raised, and will reply more fully in the Institution "Proceedings." As to lowering gear, the position of Manchester was that Portland Street was adjacent to the Dickinson Street works; and, consequently, it was a very easy matter for the men to run-out a tower waggon and attend to the lamps. He did not, however, say he would adopt tower-waggons in the event of further extensions of the street lighting. Probably the time taken in getting from the works to the streets in which the lamps were placed would be prohibitive. With regard to the question of the actual cost to the department, there was nothing added for profit. At the same time, it was only fair to point out that these figures were very ample. Replying to Mr. Harrison, he said that the high-pressure gas in Manchester was 55 to 60 inches water-gauge, which was substantially lower than the pressure used in London; but even with this reduced pressure there was a considerable amount of leakage from the Manchester high-pressure mains, as they knew to their cost. As to Mr. Bailey's remarks on dioptric globes, all he could say was that in Manchester they had decided to tackle the problem on other lines than those adopted in London; and he ventured to think that the results obtained would be of some interest, and, he trusted, of some value. With regard to Professor Morris's remarks as to the effect of fog on the mantles, so far as he had been able to ascertain there seemed to be choking-up of the gas-burners and mantles by the actual deposit of carbon. As to the question of candles per cubic foot of gas, he thought the time had gone by when the gas people claimed anything like 50 or 60. He believed that quite recently Mr. Goodenough himself had dropped the figure down to 40; and even this was on the high side. The calorific value of the Manchester gas was 550 B.Th.U. gross, and 500 B.Th.U. net. He did not agree with Mr. Bailey that the grading operation on the globes was likely to diminish the life of them. It had not had this effect on either the inner or the outer globes.

Mr. Ratcliff also replied, and dealt with the photometrical side of the discussion. Among his remarks, he said the "Flicker" photometer was a very tiring instrument to work with; but it had the advantage that one did appear to get some definite results, though exactly what these results were, he could not say. He did not quite follow Mr. Edgcumbe's calculation of foot-candle-yards, which seemed rather a complicated quantity. Professor Morris had raised the question of a foggy atmosphere. They had tried to make some tests in the fog with a luminometer; but the fog was so shifting that they did not get very consistent results. With regard to Mr. Dow, he supposed it was impossible absolutely to remove glare under reasonable commercial conditions; but the frosting of the globes used at Manchester had certainly removed the view of the arc which was obtained at the lower angles to the horizontal. At the smaller angles, one did not see the arc; and the effect of the inner and outer globe was to reduce the intrinsic brilliancy very much, and also the glare, which was by no means so noticeable. Glare was most noticeable at the angles at which it was possible to observe the naked arc; and the frosting had eliminated this.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

The members of the Western District of the Scottish Junior Gas Association held a meeting in the Royal Technical College, Glasgow, on Saturday. In the absence of the President (Mr. F. L. MacLaren, of Dumbarton), the Vice-President (Mr. John Wilson, of Falkirk) occupied the chair.

Mr. G. T. M'Killop, of Broxburn, read a paper on

THE VERTICAL RETORT OF THE SHALE-OIL INDUSTRY.

The shale oil industry owes its existence to Dr. James Young, who in 1847 had his attention directed to a small stream of oil flowing from the top of a coal-working at Alfreton, Derbyshire. The supply became very soon exhausted, and Dr. Young then set out to imitate the process by which he thought the oil had been produced, by the action of a gentle heat on coal; and in 1850, he brought out his famous patent for "obtaining paraffin oil, or an oil containing paraffin, from bituminous coals by slow distillation." During the progress of his experiments, a highly bituminous mineral called Boghead coal or Torbanehill mineral was found near Bathgate. It contained from 60 to 70 per cent. of volatile matter, and on slow distillation gave from 120 to 130 gallons of crude oil per ton. This mineral was worked out by 1862. The retorts first erected at Bathgate were the ordinary horizontal gas-retorts, coal fired; and I do not think any attempt was made to utilize the permanent gas as fuel. The condensed water containing ammonia, sulphides, &c., was allowed to pollute the neighbouring streams. Although oil-works and gas-works have retorts in common, their ultimate objects diverge. The oil-works try to make as much oil as possible at the lowest possible temperature; gas-works use a high temperature to get a large yield of gas.

Even at that early stage in oil-retort evolution, Young was not

satisfied with the quality of the oil; and about two years afterwards he erected three cylindrical cast-iron retorts vertically in a fire chamber common to the three. The tops were surmounted by hoppers, and the bottoms were sealed by dipping into troughs of water. The retorts were some 18 inches diameter and about 11 feet high. Owing to the tendency of the Boghead mineral to swell and stick in the retort, Young next devised a tapered cylindrical retort, set in brickwork, with the larger end down and sealed in water. Each retort was fitted with an internal helical screw; the shaft projecting upwards, and driven from a main shaft by a gear. The helical screw was kept in slow motion, and carried the contents of the retort slowly downwards and prevented sticking. This method was quite successful, and was continued for eight years. Then a new shape of retort was devised with an elliptical cross section and much larger at the bottom than the top. This retort gave the fire a greater surface to play on, and less depth of material for the heat to penetrate.

The advantages of the vertical retort over the horizontal for oil-producing purposes were early realized. A larger yield of oil of better quality was obtained, due to the better and easier regulation of the temperature.

In 1861, it was found that a current of steam passed up through the shale increased and improved the yield of oil; and the yield of ammonia also was doubled. Steam in the horizontal retort was not so effective, as it passed over the top of the shale. The progress made in retorting shale may be summarized thus: (1) Adoption of a vertical retort. (2) Construction of a retort with an elliptical cross-section. (3) Introduction of steam at the base of the retort.

The next step forward was to try to utilize the carbon left in the spent shale (about 12 per cent.) to give gas. The former retorts were worked at the lowest possible temperature to get good hydrocarbon oil, and did not give enough permanent or uncondensable gas to fire themselves. They had to be assisted by coal fires. The Henderson retort of 1873 was the first of this series, and was very successful. These retorts were of cast iron, elliptical in cross section, and were placed in a vertical position in an oven that was common to four. This retort effected a saving of 50 per cent. in coal as fuel over the other retorts, mainly due to the gas, which has a high calorific value, assisted by the combustion of the residual carbon in the furnace. This was a good oil-retort, but wasteful of ammonia, as the nitrogen in the badly exhausted shale did not form ammonia but was lost in the spent flue gas. From this type of retort with a good shale the yield was 27 gallons of oil per ton and 14 lbs. of sulphate of ammonia.

The next advance was the retort of Messrs. George T. Beilby and William Young in 1881. This quickly superseded all the other forms, as it gave a good yield and quality of oil, and utilized the carbon and nitrogen in the oil-exhausted shale to give gas and ammonia. The modern retorts are modifications of this one, which brought up the yield of ammonia from 14 lbs. in the Henderson retort to 40 lbs.

We now come to our present-day retorts and method of working. The shale is brought up from the mines in hutches by an endless rope, tipped into a shoot, and crushed between heavy toothed rollers into lumps of 5 lbs. and less. From the shale-breaker, it is delivered into hutches holding about 18 cwt., and conveyed by endless rope to the top of the retort-bench, and there emptied into the charging tanks or hoppers of the retorts.

The present Henderson retort is vertical; the total height from the ground to the top of the bench being about 63 feet. The iron part of the retort is elliptical in shape and tapered, and is surmounted by a hopper carrying a 24 hours' supply of shale. The iron part is 2 ft. 9½ in. by 1 ft. 2⅜ in. at the top, and 3 ft. by 1 ft. 5 in. at the bottom, and is 14 feet long. The bottom part of the retort is of fire-brick, rectangular in shape, and 20 feet long. The taper is continued; and at the base of the brick retort the dimensions are 4 ft. 8 in. by 1 ft. 10 in. Here are two toothed rollers which support the column of shale, and regulate the speed at which it is allowed to come down through the retort. Beneath the rollers is an iron receptacle to receive the spent shale. This is emptied four times in the 24 hours, and the exhausted shale is sent to add to the large heaps which are seen adjacent to all shale-works. In a bench there are two rows of retorts—twenty or more in each row. The bench is built up 6 feet clear of the ground, to allow the hutches to be run under to discharge the spent shale.

The superiority of the present Henderson retort over its predecessors is that no coal gas or producer gas is required to aid the retorting of the shale. From the shale itself, without deteriorating the quality of the oil or sacrificing any of the condensable products, sufficient gas of good calorific value is obtained to maintain the necessary temperature of the retorts, and this with shales much inferior to those which used to be put through the old retorts. The fuel gas is led along each side of the bench of retorts at a pressure of 6 inches, and the gas is led into the bottom of the brick retort by 2-inch pipes—three pipes for every two retorts, each pipe controlled by a valve. The centre pipe feeds the middle flue, which runs from front to back, then up and from back to front, up again, and so on till it reaches the oven of the iron retorts. The oven has four retorts, and the spent gases are drawn off by two vertical flues in the sides of the oven. These flues are controlled by dampers, and the burnt gases are allowed to escape into the atmosphere from short iron chimneys carried up to clear the charging hoppers. When working, the base of the retort is at the highest temperature; that of the flues being 1100° C. at the two bottom rows of ports. The heat decreases higher up the retort; being about 800° C. at the junction of the iron and brick retorts and 600° at the middle of the oven in which the iron retorts stand. These are flue temperatures, and necessarily higher than the actual temperature inside the retort.

The shale moves slowly down from the charging-hopper into the iron retort, where it meets the hot products of distillation coming up; and as it moves on, it is subjected to a slowly increasing heat. By the time it is through the iron retort, the "kerogen," or oil-forming material, has been distilled off at the lowest possible temperature, and in the presence of steam, which protects the hydrocarbons. The partially exhausted shale, containing carbon and nitrogen, moves slowly downwards into the fire-brick retort, and as it descends is subjected to a rapidly increasing temperature and the action of a current of steam. The carbon and steam react, giving hydrogen and carbonic acid, and some carbonic oxide when the temperature is high enough; and the ammoniacal nitrogen is evolved from the shale in the form of ammonia. The presence of a liberal supply of steam prevents the decomposition of the ammonia during its passage through the hot area. After passing the rollers, the exhausted shale drops into the bottom hopper and is withdrawn at regular intervals.

The condensed ammonia water is about 100 gallons per ton of shale, and the quantity of sulphate of ammonia from 40 lbs. to 60 lbs., according to the particular seam. A good oil shale will yield 25 gallons of oil per ton, of ·868 sp. gr., and give 8000 cubic feet of permanent gas, containing 56·8 per cent. of combustible matter. The volatile matter in good shale (Broxburn seam) is 25·5 per cent.; the residue, 74·5 per cent. The ultimate percentage composition of volatile matter is: Carbon, 19·12; hydrogen, 2·94; nitrogen, 0·54. From every 100 tons of shale put through, there are 75 tons to be drawn and put on the heaps; and as we put through upwards of 2000 tons per day, it can be understood that the heaps in the shale districts are rapidly becoming mountains. The life of these large retorts is proportional to the usage they get. If they are overdriven, by too much shale being put through, then the flue temperatures have to be raised, and the retorts stick and give trouble. We find our retorts are good for some eight or nine years without any great amount of repairs. The retorting is continuous.

The products of destructive distillation at this stage are crude oil, condensed water containing ammonia, and gas. There is no difficulty in separating one from another. The oil is light, floats easily on the water, and is not viscous. The scrubbed gas goes to fire the retorts; the condensed ammonia water and water from the scrubbing towers is pumped into the Henderson ammonia stills, where the ammonia is driven off and trapped in a saturator with sulphuric acid. The sulphate of ammonia made is almost white, with 25 per cent. of ammonia when dry. The crude oil of ·870 to ·875 sp. gr., which is dark brown in colour with a green fluorescence, and which solidifies at about 80° Fahr., is pumped across to the refinery and dealt with there.

Distillation gives from the crude oil: (1) Crude motor spirit and naphthas; (2) light oil (once run); (3) heavy oil and paraffin (once run); (4) heavy oil and paraffin from the pot stills with coke as a residue and a quantity of permanent gas. The coke is valuable, as it contains only about 1 per cent. of ash. The gas is collected, and a quantity goes to the gasholders to light the village; the surplus being returned to heat the stills. The fractions are refined with oil of vitriol, which removes a quantity of heavy tar, treated with weak soda to remove traces of acid, and separately re-distilled. This treatment and distillation process is repeated until the products are at marketable standard.

The products obtained by the fractional distillation and refining of crude oil are (in addition to gas and coke):

	Per Cent.
Motor spirit, ·715 sp. gr. Naphthas, ·730 to ·745 sp. gr.	3·5
Oil for internal combustion engines, ·770 to ·785 sp. gr. Lamp oils, ·795 to ·805 sp. gr. Lighthouse oil, ·810 sp. gr.	30·3
Gas or fuel oils, ·850 to ·865 sp. gr.	10·4
Lubricating oils, ·885 to ·895 sp. gr.	28·8
Paraffin wax—	
Soft, melting point 100° to 110° Fahr.	4·0
Hard for candles, melting-point 120° to 125° Fahr.	6·1
	73·1

The loss in refining is in tar and decomposition of hydrocarbons giving gas and coke. The proportion of products obtained varies within limits according to the temperatures employed in distilling and the quantity of steam used. The lighter oils are becoming increasingly utilized for internal combustion engines, as they are of high calorific value—about 19,000 B.Th.U. per pound; and if combustion is good, the products are harmless. The gas or fuel oils, which used to be largely taken by gas-works and railways to enrich poor gas or to make oil gas, which is very compressible, are now being very much employed by high-speed vessels of the Navy. It is the ideal fuel for rapid steam-raising. It is light in weight, and not easily frozen, even by extreme cold. One ton is almost as good as two tons of coal, and, with a proper burner, it is smokeless.

Formerly the gas went to waste; and we had a small gas-works. Some years ago it was considered worth while to connect up the gas outlets of the coking-stills, and we found we had an ample supply of a good gas, practically free from sulphur, containing no carbon monoxide, and of high illuminating value. The

coal retorts were stopped, and the gas, mixed with air to make it suitable for use with mantles, was sent to the gasholder. It does very well; and the purifiers can run for months without attention. The composition of the gas is rather peculiar, as it is a mixture of permanent gas, very volatile hydrocarbons, and air. We found the proper admixture of air quite easy to regulate by having incandescent burners, upright and inverted, on the inlet and outlet supply in the pumping-house; and the man in charge kept these giving a good and clear light. When the gas gets poor or too rich, it is passed to the furnaces. With a little practice, the man keeps his mixture right within 3 per cent.

At the close of his paper, the author referred his audience to an article on the subject by Dr. Beilby, in the "Journal of the Society of Chemical Industry in 1897" [Vol. XVI., p. 874.]

DISCUSSION.

Mr. A. Scott (Provan), referred to Mr. M'Killop's analysis, which, he pointed out, indicated in the residue or ash of a good average shale 12·23 per cent. of ferric oxide and 22·14 per cent. of alumina. He said there were 2000 tons of shale used daily, and 75 per cent. of it was turned on the heaps. Was it not possible to get all this ferric oxide out of the spent shale? And was it worth while recovering the alumina?

Mr. A. Wylie (Glasgow) remarked that he realized, with most of the members, that they had something to fear from oil as an illuminant. He had recently noticed an advertisement which claimed to give twelve lights of 60-candle power for the sum of 1d. Compared with gas, he wondered how this came out. He wished from Mr. M'Killop an answer to one point. They heard so much nowadays of the stock of coal some day going down. Were they really rich in the shale fields which they had? Would these fields become exhausted in the near future?

Mr. J. W. Napier (Alloa) said they must look upon the shale oil industry as the sister industry of gas manufacture. The shale industry began in 1851; and it was interesting to observe that the first retort was a horizontal one. It only required about ten years for the industry to recognize the advantages of the vertical retort. The gas industry was more than a hundred years old, and only now were those engaged in it recognizing the value of verticals. In this respect, he thought they should pay homage to the memory of Mr. William Young. He should like to ask Mr. M'Killop what were the labour costs per ton of shale; and what had been done in recent years in the endeavour to reduce these costs. The author had stated that the life of the vertical retort was eight or nine years. The process, of course, was a low-temperature one. It would be interesting to know the life of the vertical retort for gas. At any rate, these retorts were the last word so far as labour costs were concerned. It was to the chemist that they now had to look for any further reduction.

Mr. D. Fulton (Helensburgh) said the author had given them the composition of the permanent gas, and had stated that the nitrogen was 16·2 per cent. They recently had Dr. Davidson telling them that only 1 per cent. of nitrogen was evolved from coal; the rest being from the atmosphere. Would Mr. M'Killop tell them something about the remaining 15·2 per cent.? Had they any carbon forming in the retorts? The life of the shale retorts had been given as eight or nine years; but Mr. M'Killop told them they were working continuously. In gas-works, where all the gas was to be made from vertical retorts, these would at one time be working and then be off. The question, therefore, for the gas manager was whether the retorts would stand the heating-up and cooling-down.

Mr. M'Nicol (Dawsholm) remarked that the author had stated that the time the charge took to go through the retort was about 70 hours, and the retort was 63 feet high. Had there been any attempt to make the retort higher, so as to give a greater speed to the shale going through?

Mr. Alex. Wilson (Glasgow) said many of them had learned much from the method of work of the vertical retorts in the shale-oil industry. He himself had given the matter a great deal of attention. It was marvellous to think of the progress made in this industry due to the alteration in the method of working from horizontal to vertical retorts. He supposed they had effected a great many other economies in working; but they could not have done this had they not adopted the vertical system. In the gas industry, they had quite a different problem to follow from that of the shale-oil industry. Mr. M'Killop had given figures to show that, when working, the base of the retort was at the highest temperature; that of the flues being 1100° C. at the two bottom rows of ports. The heat decreased higher up the retort; being about 800° C. at the junction of the iron and brick retorts, and 600° C. at the middle of the oven in which the iron retort stood. He (Mr. Wilson) thought the probability was that inside the retort the temperatures were a great deal more equal than was likely to be the case outside, on account of the large quantity of steam passing up from the bottom of the retort. The steam was bound to abstract a great deal of the heat. There was a material difference in the carbonizing of coal for gas-making and the carbonizing of shale for oil-making purposes. In most of the systems—the continuous and the intermittent-continuous—the heat was highest not exactly at, but close to, the top, and tapering off down to the bottom. A question had been asked about the repairs. He could not say very much about this yet; but he thought it would be found that the repairs on verticals would be very much lighter than those on horizontals. On the latter, there was expansion when the bench was lighted-up, and when it was cooled-down they never got the expansion back again. He thought it would be found that in the verticals, when they came to let them down as they cooled they would sink by their own weight, and they would not have all the cracks to fill up. He had hopes that the verticals would go for a long time without repairs; and when they had to be mended, it would only be in a small section at the top, which could be easily reached, and the work done very quickly.

Mr. Waddell said he should like to acknowledge how much he had gained from going round the different oil-works; and he said he was sure those gas managers who had not yet done this had missed much. In visiting oil-works, they would find that the size of the heating flues was altogether different from those in gas-works, and would be inadequate when using producer gas, as gas people did. The chimney was one of 9 or 10 inches, which was also quite inadequate for them. He thought that in the matter of grading off heats they would come into a position pretty much like that of the oil-work retorts.

Mr. H. O'Connor (Edinburgh), in the course of few interesting remarks, pointed out that the raising of the question of the comparative use of temperatures with gas and oil works showed how valuable such a paper as that which had been read was to gas managers.

The Chairman remarked that it was interesting to know how the mere mention of vertical retorts seemed to cast a glamour over gas people; and they were indebted to the senior members for being present. He should like to know from Mr. M'Killop why the iron part of the retort was elliptical in section.

Mr. M'Killop, replying upon the discussion, said, with regard to the question of utilizing the ferric oxide, a great many people had tried their hands on the spent shale heaps; but he did not know that they had been able to extract the iron or alumina. So far as a commercial scheme was concerned, no use had been made of the heaps. As to the duration of the shale fields, they were at the moment going pretty deep—400 feet down. Unfortunately, the deeper shales were denser than the others, and there was less volume of oil per ton. But there were large shale fields still unattacked. As to labour costs, the number of men employed with the new Henderson retort was considerably less than with the older form. On the question of the life of the retorts, they found that after eight or nine years the iron was all right, but that the brick had worn through. As he had stated, 16·2 per cent. of nitrogen was found in the gas. It came in from the atmosphere. There was sometimes carbon inside the retorts. They knew then that the temperature had been too high, or that the steam-pipe of the particular retort had been choked up. Perhaps in theory a higher retort would be better; but in practice it had not been tried. He thought the present Henderson retort was the largest put up.

A hearty vote of thanks was accorded to the author.

The Engineers' Year Book.

This is a book of reference for engineers of all kinds—containing, as it does, some twenty-eight sections, which are composed of notes, tables, &c., for every class of engineer; while there are descriptions of machinery and apparatus which are entirely up-to-date. The fact that the book is published afresh each year, and is thoroughly revised by the various contributors (superintended by Mr. H. R. Kempe, Electrician to the Post Office), is a guarantee that it is reliable in every respect. The section on "Gas and Gas-Works" has been revised and amplified by Mr. Henry O'Connor. Special contributions by Professor Vivian B. Lewes, on "Acetylene Gas and its Applications," and by Mr. E. Scott-Snell, on "Petrol Air Gas" are included. The contents of this section are as follows:—

To calculate air required to burn coal; average products of distillation; retorts; dip-pipes; hydraulic mains; condensers; impurities in gas leaving condensers; tar and liquor tanks; exhausters; scrubbers; analysis of ammoniacal liquor; purifiers and purification; average analysis of bog ore; Weldon mud; use of air; proportion of oxygen required for purification; construction of gasholders; tanks; pressure of water against tanks; thickness of wrought-iron sheets for tanks; riveting of plates; contents of crown of gasholders; weight of holders; sulphate of ammonia notes; illuminating power of gas; composition of gas; weight of gas; weights of gas-pipes and connections; cement pipe joints; wet meters; dry meters; volumes of oxygen and air required for combustion of various gases; volume of air to burn one cubic foot of gas of any composition; kindling explosive mixtures of gases and air; composition of water gas; formulæ for gas-mains; table of constants for friction in gas-mains; gas tests as prescribed by Metropolitan Gas Referees; illuminating power; test for sulphuretted hydrogen; tests for sulphur compounds; tests for calorific power; tables of illumination; reflection power of coloured surfaces; burners; cost of gas-works; incandescent mantle burners; acetylene gas and its applications; dissolved acetylene; acetylene lighting; autogenous welding; automatic motor starters; petrol air gas; description of air-gas plants and their operation.

The book can be thoroughly recommended, more especially to those who are interested in the construction and maintenance of a gas-works, and may take the place of a small library of engineering works which otherwise the engineer might find necessary.

HEATING FURNACES AND THEIR RELATION TO THE HEAT TREATMENT OF METALS.

A LECTURE was delivered by Mr. J. LORD, of the Manchester Furnaces, Limited, at the Royal Technical College, Glasgow, last Wednesday week, on "Heating Furnaces and their Relation to the Heat Treatment of Metals." The lecture was illustrated by lantern views and practical demonstrations; and it was given before a large audience, presided over by Bailie Paxton, the Convener of the Glasgow Gas Committee. The lecturer pointed out that, in preparing his matter, it had been his object throughout, especially with regard to furnaces, to treat the subject on broad lines. Though a manufacturer of furnaces himself, he had no desire to confine his remarks mainly to the type he made. In fact, he had written to every manufacturer of furnaces in the country stating his purpose. With regard to the question of steel, it was his intention to take this as received from the makers, and to go briefly with it through the various processes of annealing, case-hardening, hardening, and tempering. The following are the portions of the lecture of more direct interest to "JOURNAL" readers.

ANNEALING.

According to the generally accepted definition of the term, the object of annealing steel is to soften it in order that it may be machined at the minimum cost of labour and tools. We recognize also that annealing is for the purpose of eliminating internal strain or brittleness which is set up in hammering, rolling, and finishing. It brings the steel to a uniform and regular condition; so that when it is heated for hardening, equal expansion is obtained, and also equal contraction when cooled. Further, the life is considerably increased by this process. The type of furnace I should recommend would be of a semi-muffle pattern, arranged for blast or draught burners. The flues are made to give as near complete combustion as possible of the gases before entering the working chamber. This type of furnace can be successfully adapted to solid fuel, oil, producer gas, or town gas. In dealing with these four types of fuels, we will take different designs of furnaces operated with these fuels, and their cost of running.

Let us assume we desire to anneal half-a-ton of steel forgings. To anneal this quantity at one time would require a working chamber 3 feet in length by 2 feet wide by 18 inches high. This would be a reasonable size of furnace for this amount of work; no boxes being used, and the the articles or forgings being placed in the open furnace. To find the cost of types of furnaces, we will take six different methods, as follows: Solid fuel, oil, producer gas, town gas with draught burners, town gas with blast burners, and the "Bonecourt" system of surface combustion. We will assume that we pack the furnace in a cold state, or, in other words, before we apply any fuel.

Cost of Running Solid Fuel Furnace.

Annealing half-ton of steel.
Furnace. Working chamber 3 ft. by 2 ft. by 18 in. high.
Fuel—Solid. One-half coke, one-half coal, at 13s. 4d. per ton.
Rate of consumption per hour, 28 lbs.
Time to raise heating chamber and steel to 850° C., 5 hours.
Total number of lbs. annealed, 1120.
Total amount of fuel used, 140 lbs.
Total number of lbs. of fuel used per lb. of metal annealed, 0·125.

	s.	d.
COST.—140 lbs. of fuel at 13s. 4d. per ton	0	10
Labour, 2 hours at 6d. per hour	1	0
Storage for fuel	0	1
Average per hour, 4·6d.	1	11

No labour costs are charged for packing and unpacking furnace. The costs made are actually the running of the furnace.

Cost of Running by Oil.

Annealing half-ton of steel.
Size of furnace as before.
Fuel—Crude oil, at 4d. per gallon.
Rate of consumption per hour, 2 gallons.
Time to raise furnace and steel to 850° C., 3 hours.
Total number of lbs. annealed, 1120.
Total amount of fuel used, 6 gallons.

	s.	d.
COST.—Oil, 6 gallons at 4d. per gallon	2	0
Power for blower, 1d. per hour	0	3
Storage for oil	0	1
Average per hour, 9·3d.	2	4

We have to take into consideration that the price of oil is continually going up, while the price of gas is continually coming down. I understand that the rate for gas supply in Glasgow for manufacturing purposes is 1s. 6d. per 1000 cubic feet for over 20,000 cubic feet of gas used annually. Therefore I am basing my calculation on this rate, or 55 cubic feet for 1d.

Cost of Running Producer-Gas Furnace.

Annealing half-ton of steel.
Furnace as before. Blast burners.
Fuel—Producer gas using air under pressure. 135 B.Th.U.
Consumption, 1540 cubic feet per hour.
Time to raise furnace and steel to 850° C., 4½ hours.
Total number of cubic feet required, 6930.
Total number of lbs. annealed, 1120.
Total number of cubic feet of gas used per lb. of metal annealed, 6·18.

	s.	d.
COST.—6930 cubic feet, at 2d. per 1000	1	1½
Labour, 1½ hours, at 6d. per hour	0	9
Depreciation on producer plant	0	1
Power for blower, 1d. per hour	0	4½
Average per hour, 6·22d.	2	4

In basing my price of gas at 2d. per 1000 cubic feet, you will recognize that it will require a fair-sized plant to produce the gas at this price. Also the cubic feet are based on 4 to 1 of town gas.

Cost of Running Town Gas, Draught Burners.

Annealing half-ton of steel.
Furnace as before. Draught burners.
Fuel—Town gas. No blower required.
Consumption, 385 cubic feet per hour.
Time to raise furnace and steel to 850° C., 5 hours.
Total number of cubic feet required, 1925.
Total number of lbs. annealed, 1120.
Total number of cubic feet of gas used per lb. of metal annealed, 1·8.

	s.	d.
COST.—1925 cubic feet of town gas, at 1s. 6d. per 1000	2	11
No power is required. Average per hour, 7d.		

Cost of Running—Furnace, Town Gas, Blast Burners.

Annealing half-ton of steel.
Furnace as before, with blast burners.
Consumption, 385 cubic feet per hour.
Time to raise furnace and steel to 850° C., 3 hours.
Total number of cubic feet required, 1155.
Total number of lbs. annealed, 1120.
Total number of cubic feet of gas used per lb. of metal annealed, 1·02.

	s.	d.
COST.—1155 cubic feet of gas, at 1s. 6d. per 1000.	1	9
Power for blower, 1d. per hour.	0	3
Average per hour, 8d.	2	0

Taking the latest type of furnace as submitted by Professor Bone, with his method of surface combustion—gas and air under pressure. The figures given before the American Society last year as obtained with his system, as against the present system, and against the best-type furnace on the market, show a clear reduction or saving of gas of fully 60 per cent., coupled with greater efficiency in obtaining the same results. Possibly, if this was brought on a practical and commercial basis, it would not be quite so great; so, instead of taking or figuring on the 60 per cent. reduction, we will make the basis a 25 per cent. reduction, which would work out in the following manner, figuring all other conditions equal.

Cost of Running Bonecourt Furnace.

Annealing half-ton of steel.
Furnace as before, using gas and air under pressure.
Consumption, 290 cubic feet per hour.
Time to raise furnace and steel to 850° C., 3 hours.
Total number of cubic feet required, 870.
Total number of lbs. annealed, 1120.
Total number of cubic feet of gas used per lb. of metal annealed, 0·77.

	s	d.
COST.—870 cubic feet of gas, at 1s. 6d. per 1000	1	4
Power for blower, 1½d. per hour	0	4½
Average per hour, 7d.	1	8½

Tabulating the various costs, they would show as follows:—

	Amount of Time Taken.	Total. s. d.	Average per Hour.
Solid fuel	5 hours	1 11	4·6d.
Oil	3 ,,	2 4	9·3
Producer gas	4½ ,,	2 4	6·22
Town gas, draught burners	5 ,,	2 11	7·00
Town gas, blast burners	3 ,,	2 0	8·00
Surface combustion	3 ,,	1 8½	7·00

This clearly proves, so far as annealing is concerned, and packing the furnace cold, that gas can be used with the same economy (if not greater economy) as any other form of fuel, together with greater efficiency, because you can invariably get the gas at the same standard uniform quality and pressure. To obtain the best results with gas, a pressure of from 2 to 3 inches of water is necessary. In using gas, you have no initial outlay beyond the piping—no depreciation charge, and no labour charge. A greater uniformity of heat can always be relied upon, which means greater production and better work.

CASE-HARDENING.

The question of case-hardening is a very interesting subject. A great amount of this class of work is done to-day, and still more will be done in the future. The fuel used varies; but the

furnaces can be run by solid fuel—*i.e.*, coal or coke—oil, producer gas, or town gas. As in the annealing process, we will take these types of fuels and the different designs of furnaces, with their running costs. Taking a standard furnace as a basis, a size generally used for the work is 4 feet long by 2 feet wide by 18 inches high.

Running Costs of Solid Fuel Furnace.

Furnace—Working chamber 48 in. by 24 in. by 18 in. high.
Operation—Carbonizing.
Fuel—Solid, coal or coke.
Length of time in operation, 10 hours.
Length of time to raise to 1000° C. from cold, 4 hours.
Amount of fuel consumed during that period, 2 cwt.
Amount of fuel consumed afterwards, 1 cwt. 98 lbs.
Total amount of fuel used, 3 cwt. 98 lbs.
These consumptions are based approximately on the furnace being used with a reasonable amount of work placed in same.

	s.	d.
Cost.—Fuel per 10 hours, at 13s. 4d. per ton	2	7
Labour, 3 hours, at 6d. per hour	1	6
Storage for fuel	0	2
Average per hour, 5·1d.	4	3

Assuming the furnace had been kept in during the night or dampened-down, to raise the furnace to the required temperature the following morning would take about 2½ hours. Therefore, this would bring the cost down to just under 4s. for the 10 hours.

Cost of Running Oil Furnace.

Furnace as before.
Operation—carbonizing.
Fuel—crude oil.
Length of time in operation, 10 hours.
Length of time to raise to 1000° C. from cold, 2½ hours.
Amount of fuel consumed during that period, 7½ gallons.
Amount of fuel consumed afterwards, 15 gallons.
Total amount of fuel used, 22½ gallons.

	s.	d.
Cost.—22½ gallons of oil, at 4d. per gallon	7	6
Labour, 1 hour at 6d.	0	6
Power for blower, at 1½d. per hour	1	3
Storage for oil	0	2
Average per hour, 11·3d.	9	5

Running Cost of Producer-Gas Furnace.

Furnace as before.
Operation—carbonizing.
Fuel—producer gas, 135 B.Th.U., with air under pressure.
Length of time in operation, 10 hours.
Length of time to raise to 1000° C. from cold, 3½ hours.
Amount of fuel consumed during that period, 9800 cubic feet.
Amount of fuel consumed afterwards, 13,000 cubic feet.
Total amount of gas used per 10 hours, 22,800 cubic feet.

	s.	d.
Cost.—22,800 cubic feet of gas, at 2d. per 1000	3	9
Labour, 3 hours, at 6d. per hour	1	6
Depreciation on producer plant	0	2
Power for blower, at 1½d. per hour	1	3
Storage for producer plant and fuel	0	2
Average per hour, 8·2d.	6	10

Assuming the furnace had been run direct from the producer under the regenerative principle, and not under pressure, the amount of gas used in 10 hours would be 23,825 cubic feet. All other figures equal, with the exception of power, the cost would work out at 5s. 10d. per 10 hours working. Average per hour, 7d.

Running Cost of Furnace with Town Gas, Blast.

Furnace as before.
Operation—carbonizing.
Fuel—town gas, with air under pressure.
Length of time in operation, 10 hours.
Length of time to raise to 1000° C. from cold, 2½ hours.
Amount of fuel consumed during that period, 1780 cubic feet.
Amount of fuel consumed afterwards, 3750 cubic feet.
Total amount of gas used per 10 hours, 5500 cubic feet.

	s.	d.
Cost.—5500 cubic feet of gas, at 1s. 6d. per 1000	8	3
Power for blower, at 1½d. per hour	1	3
Average per hour, 11·4d.	9	6

Assuming that you run the same furnace with town gas using draught burners, the total consumption per 10 hours would be 6330 cubic feet, working out at 9s. 6d. for the 10 hours. No power is required, and no labour. Average per hour, 11·4d.

You will undoubtedly notice that the cost of running with town gas, whether by draught or blast burners, is the same. The point, as stated previously, is production. Therefore the difference that does exist between the two types is that the blast type is 25 per cent. quicker in heating, with an output of 15 to 20 per cent. more work.

It is to be noted that the consumptions given are not assumed or catalogue rates, but are what is being done in actual practice—not in laboratory, but in standard workshop, practice.

We will now take a "Bonecourt" type of furnace, run with both gas and air under pressure; the pressure being at the rate of 27 inches of water.

Cost of Running "Bonecourt" Furnace.

Furnace as before.
Operation—carbonizing.
Fuel—town gas, with both air and gas under pressure.
Length of time in operation, 10 hours.
Length of time to raise to 1000° C. from cold, 2½ hours.
Amount of fuel consumed during that period, 1313 cubic feet.
Amount of fuel consumed afterwards, 2814 cubic feet.
Total amount of gas used per 10 hours, 4132 cubic feet.

	s.	d.
Cost.—4132 cubic feet of gas, at 1s. 6d. per 1000	6	3
Power for fan, at 2d. per hour	1	8
Average per hour, 9·5d.	7	11

Tabulating the costs of these various furnaces working continually for 10 hours, and starting from cold, would be as follows:—

Furnace—Working chamber, 4 feet by 2 feet by 18 inches high.

	Average per Hour. d.		Per 10 Hours. s.	d.
Solid fuel	5·1	..	4	3
Oil	10·3	..	9	5
Producer gas	8·2	..	6	10
Town gas, air under pressure	11·4	..	9	6
Town gas, draught burners	11·4	..	9	6
"Bonecourt" furnace	9·5	..	7	11

In this size furnace, we have to admit that this does not show quite as good a result, so far as fuel cost is concerned, in favour of gas; but there are many points which equalize and stand far ahead in its favour. In a gas-furnace, you are assured of the same constant temperature at all times, without labour cost. I think you will admit with me that this is the critical point. When you are assured that the right temperature can be, and is, maintained with the minimum cost of labour and responsibility, the cost of gas is not so great as would appear on the surface. There is also the question of space and outlay. A gas-furnace generally only takes one-half to two-thirds the space of a solid-fuel furnace. No storage is required for fuel, no chimney is needed; and the whole operation is cleaner. Where men have clean surroundings to work in, as a rule, better work is produced. The time taken to heat-up the work in a gas-furnace working with draught burners is about equal to solid fuel. If run by blast burners or gas under normal pressure and air under 1½ to 2 lbs. pressure, the heating-up is approximately 25 per cent. quicker.

Now let us take a rough cost of laying down two furnaces, one for solid fuel and one for gas, with the running cost for one year's work, together with the amount of work that can be produced between them. This, I think, is a fair way of finding the actual costs of the furnaces under each system. We take the same furnace as we have used for carbonizing, 4 feet long by 2 feet wide by 18 inches high.

Cost of Solid-Fuel Furnace Working for One Year.

	£	s.	d.
Initial cost of furnace with foundation	90	0	0
Chimney, 25 feet high	25	0	0
Cost of fuel, 50 hours per week, 50 weeks per year	32	5	0
Labour, 900 hours, at 6d. per hour	22	10	0
Repair costs	2	10	0
Storage, at 2d. per day	2	10	0
	£174	15	0

Cost of Gas-Furnace, "Bonecourt" System.

	£	s.	d.
Initial cost of furnace	60	0	0
Initial cost of pressure fan	25	0	0
Fuel cost, for 50 hours per week, 50 weeks per year	75	0	0
Power for running pressure fan	2	10	0
Repair cost	2	10	0
	£165	0	0

Taking the question of output of work between the two furnaces, the gas-furnace is 15 per cent. quicker in output. Therefore, assuming an average basis for the output from the solid fuel of half a ton per day of 10 hours, this will give you a production for the year of 125 tons. Add to this quantity an increase of 15 per cent., which gives a production of 144 tons per year—the difference favouring a gas-fired furnace. I am speaking now of properly-designed furnaces suitable for the work in question.

HARDENING.

The hardening and tempering of a piece of steel is an operation which, to the casual observer, may appear very simple; but it is undoubtedly one of the most delicate operations connected with mechanical art.

Questions are very often asked in regard to running furnaces by the different methods—that is, by draught burners which are commonly recognized as bunsen burners; blast burners, which work with gas under normal pressure, combined with air under a pressure of from 1 to 2 lbs. per square inch; and also with high-pressure gas and gas and air under pressure. It would probably be well to make one or two comparisons. I want it to be clearly understood that I am making these comparisons purely on the question of efficiency and economy.

In referring back to the furnaces used for annealing, you will find that the draught furnace took 5 hours to get to a temperature of 850° C., with a total consumption of 1925 cubic feet; while with

blast burners it only took 3 hours, with a consumption of 1155 cubic feet. Further still, with gas and air under pressure, and adopting the "Bonecourt" system, the total number of cubic feet consumed was only 870. Taking the latter figure of 870 cubic feet, as against 1925 used by the draught burner, we have a saving of over 50 per cent. in fuel cost, with the same efficiency of heating. Also taking the blast burner as against the draught burner, we show a saving of 33⅓ per cent., with the same efficiency on gas alone, together with two hours' quicker heating.

In further research work some time ago, a test was made on a standard furnace with three different types of burner arrangements; and the results were as follows: Test A was with gas at natural pressure and air working at 1½ lbs. pressure. Test B was with draught burners, closed mouth. Test C was with draught burners, open mouth. The meaning of "closed mouth" is that the burners were closed in by brickwork around the mouth; whereas in the "open mouth" (as is generally used) the burners are not closed in, but have a fair amount of space all round to admit of air to the combustion chamber. This furnace was placed under tests to reach a temperature of 925° C., and each test was made to ascertain the consumption of gas required.

Test A—
Time to reach 925° C., 40 mins. Gas consumption, 101 cub. ft.
Test B—
Time to reach 925° C., 95 mins. Gas consumption, 130 cub. ft.
Test C—
Time to reach 925° C., 75 mins. Gas consumption, 165 cub. ft.

In the working of this furnace for production, the blast furnace certainly stands ahead.

In making a comparison of a furnace on surface combustion lines (as used by Professor Bone in his recent lecture), we find the following results. The figures given are for constant running—temperature in centigrade. "A" furnace by gas and air under pressure, "B" furnace, usual standard furnace with draught burners. Furnace used, 9½ in. by 5¼ in. by 3¾ in.

Temperature.	Gas Consumption. "A" Furnace.	"B" Furnace.
815 ..	21 cubic feet ..	85 cubic feet
1004 ..	35·3 ,, ,, ..	93 ,, ,,
1205 ..	58 ,, ,, ..	120 ,, ,,
1424 ..	79 ,, ,, ..	Unable to reach this temperature.

These figures prove that, so far as production is concerned, the blast-type furnace is again ahead of the draught type. There is one point very much in favour of the draught furnace, and it is that no power is required. This means that the furnace can be run night and day if necessary, without stoppage, as it does not depend upon any engine power to maintain it. Temperatures up to 1000° C. can be run very satisfactorily on this type of furnace, with efficiency. With temperatures up to 800° C., the furnace can be run with the same economy as a blast furnace—that is, of the ordinary type, not the "Bonecourt," which we must for the present consider as a special type. With temperatures over 800° C., the draught furnace does not compare in economy with a blast furnace.

Another system of gas firing which is making some considerable headway is high-pressure gas. My experience of this system goes back about seven years; and I find that for some types of furnace it works exceedingly well. Yet for melting type it is not so good as gas and air under pressure.

In a test of a standard furnace for hardening, the following results were obtained: Working with gas at normal pressure and air under a pressure of 1½ lbs. per square inch, we find that it took 140 cubic feet of gas per hour to maintain a temperature of 1000° C. Working with gas under a pressure of 4 lbs. per square inch, no air being supplied except what was drawn in at the point of the burner-mouth, the consumption was 120 cubic feet per hour to maintain a temperature of 1000° C. The results on the work placed in the furnace were better when working with gas alone under pressure, as it was impossible to draw in any excess of air beyond that required for combustion purposes. Still, it must be acknowledged that it took longer to do the work.

Another test was made on a brass-melting furnace, with the following results: Working with gas under normal pressure and air under a pressure of 2 lbs. per square inch, 56 lbs. were melted ready for pouring, with a consumption of 2¾ cubic feet of gas per pound of metal melted. This was accomplished in 25 minutes. Working with gas under a pressure of 4 lbs per square inch, no air being supplied except what was drawn in at the mouth of the burner, 56 lbs. of brass were melted ready for pouring, with a consumption of 3·1 cubic feet of gas per pound of metal melted. This was accomplished in 35 minutes. There is a possibility that if the gas was placed under a higher pressure—say, 10 to 12 lbs., greater advantage might be shown over the former system.

Tempering.

The word "tempering" is very often confused with the term "hardening;" but they are both separate operations. When a piece of steel is hardened, it becomes brittle. When the design of the piece is such that the working surface has sufficient backing, it is safe and advisable to keep the article as hard as possible; but in the case of tools having slender cutting edges, it becomes necessary to reduce the amount of brittleness. There are various methods adopted for tempering; but in each case heat must be used, and must be obtained by gas, because it cannot be successfully done by any other means.

Pyrometers.

I cannot leave the subject without referring to pyrometers. For successful and duplicated work, they are just as essential as the furnace; for by no other means can you get regular and uniform work. Through the kindness of Mr. Whipple, of the Cambridge Scientific Instrument Company, I am able to show you some of the latest types of instruments used for this work.

Bailie Paxton proposed a vote of thanks to Mr. Lord, and spoke of the development in the use of gas in Glasgow of recent years, and of the possibilities of cheaper gas if it were used to a greater extent for manufacturing purposes.

Councillor Irwin, in proposing a vote of thanks to the Governors of the College, expressed the hope that the Gas Committee would recognize the enterprise of the department in promoting the lecture, and establish a laboratory for demonstrating the uses of gas-heated furnaces.

Mr. Alexander Wilson, the Engineer and General Manager of the Gas Department, proposed a vote of thanks to the Chairman, and mentioned that the establishment of a laboratory had already been arranged for, and at an early date facilities would be provided for demonstrations taking place for the benefit of the engineering firms in the city and neighbourhood.

TAR FROM VERTICAL RETORTS.

At a Meeting of the Manchester Section of the Society of Chemical Industry held last Friday at the Grand Hotel, Manchester—Dr. Gilbert J. Fowler, the Chairman of the Section, presiding—Mr. T. Stenhouse, of Rochdale, read a paper on the subject of

TAR FROM VERTICAL RETORTS.

The author began by remarking that though vertical retorts have become practicable comparatively recently, some attention has already been given to the nature of the tar produced by them. When Mr. J. P. Leather, the Gas Engineer of the Burnley Corporation, decided a few years ago to adopt these retorts, he reckoned on getting a smaller quantity of tar for sale; but he considered that it would be of better quality, and consequently of higher market value. At Rochdale, where vertical retorts have been in continuous use for nearly eighteen months, no increase in the value of tar has been apparent, though there may have been a greater yield per ton of coal carbonized. During the past thirty years, the tar made at Rochdale has been distilled and separated into such products as 50-90 benzol, solvent and heavy naphthas, crude carbolic acid, creosote oil, and pitch. Ample opportunity has therefore been afforded of ascertaining the quality and quantities of the products obtained from tar derived solely from the horizontal and inclined retorts which were in use before the verticals were erected. As the tar from the latter retorts became mixed with that from the older settings, and more especially when all the tar made on the works came from the verticals for several weeks during last summer, it was comparatively easy to notice material differences arising in the distillation of the new tar and in the products obtained from it.

Referring to the process of carbonization in vertical retorts, the author pointed out that as the coal slides through the cold upper parts of the retorts a considerable time must elapse before it attains to the highest carbonizing temperature of the setting; and he asked whether this method of gas making did not practically amount to charging cold retorts with cold material, and gradually, but slowly, heating it to the high temperature necessary to obtain the large yield of gas required. If this was so, a considerable portion of the coal entering each retort was, he said, subjected to low-temperature carbonization; and therefore the resulting gas, as well as the tar, must be richer in the saturated hydrocarbons of the paraffin series, but poorer in the aromatic hydrocarbons containing the benzene nucleus. Assuming this to be so, there would be a lower percentage of the unsaturated hydrocarbons; and, for the same reason, smaller quantities than usual of benzol, toluol, carbolic acid, &c., would be present in the resulting tar. The author thought that the tar-yielding vapours given off in the upper part of the verticals could be altered somewhat in character by being deflected to a slightly greater extent than is the case at present to a hotter part of the retort before they escape. This would probably cause some of the liquid low-temperature paraffin products to be broken up into permanent gas and compounds richer in the benzene group.

Dealing with the quality of the tar, the author remarked that when taken from the hydraulic main it is quite fluid, but becomes very viscid on cooling. All the tar from the verticals has a lower specific gravity than the portion taken simply from the hydraulic main. After standing some time in the tar-well, it contained much more water in suspension than that from the inclined retorts when allowed to accumulate in the same way. The quality of the old tar was distinctly benzenoid, and the new tar strongly paraffinoid in character. With reference to the liquid products

separated from tar, the author emphasized the importance of creosote oil—the quantity obtained being so large. The oil from the old tar had a density of 9° to 10° Twaddel, with a tendency to become pasty and deposit naphthalene. With the advent of the new tar, the density of the oil began to fall till it stood at less than 3° Twaddel; and the oil remained quite fluid at the freezing-point of water, though much naphthalene was present.

The light creosote oil yielded by the tar from the vertical retorts complied with the conditions usually contained in contract notes, except with the one specifying that the first 25 per cent. which distils over must be heavier than water. On the other hand, it contained twice the amount of tar acids required—viz., 16 per cent. instead of 8 per cent. Paraffinoid compounds of low specific gravity were present in much greater quantity than is usually found in ordinary creosote oil derived from tar. The amount of crude carbolic acid obtainable from the new tar was at least 25 per cent. below the usual quantity, due to the use of a weaker solution of caustic soda to obtain a crude acid that would crystallize and be saleable. The new tar was poorer in phenol, but richer in the acids of higher boiling-points. There was a small yield of benzol, but a large one of solvent and heavy naphthas; and they underwent a change in composition and specific gravity. For many years the specific gravity of benzol and solvent naphtha stood at about ·880; that of heavy naphtha at ·910 to ·920. Solvent naphtha which distils over between 140° and 160° C. often has a specific gravity less than ·840. Ordinary heavy naphtha, of which the tar from verticals yielded a good quantity, would not give any distillate below 160° C., though the density did not exceed ·880 and was often less, and consequently lighter than 90's benzol. These results, in the author's opinion, show that the benzol and solvent naphtha contain appreciable quantities of the paraffin hydrocarbons, which boil at temperatures between 70° and 175° C.

In his concluding remarks, the author said one result of the adoption of vertical retorts at Rochdale had been that there is not only no naphthalene trouble with the gas, but likewise none with either the creosote oil or the naphthas, all of which contained an objectionable amount in previous years. As the yield of tar from these retorts becomes more plentiful, the large amount of tar acids present in it might be found to cause much greater corrosion than hitherto inside the tar-stills. In the author's opinion, ordinary gas-works tar will, in the near future, contain a considerable quantity of paraffin or low-temperature compounds, particularly where carburetted water gas is also made; and this fact will have to be taken into consideration when the final products are placed upon the market in increasing quantities. At present, however, the quantity is insignificant. Even in gas-works where vertical retorts have so far been established, much more tar is obtained from the older plant than from the new; and the whole mixture will not show any great difference to the general tar distiller.

DISCUSSION.

The Chairman remarked that the subject was one of increasing importance, and one in which all were interested. He expressed the hope that any members who had special knowledge of the matter would relate their experiences for the general benefit.

Mr. W. H. Coleman said he was sure they would all agree that the paper had proved extremely interesting. It was, as they were aware, the first communication to the Society on the subject of tar from vertical retorts. He would, however, like the lecturer to have given them the comparative results of tar from other than vertical retorts. Then he thought there might be an appreciable difference in tars from large and small vertical retort installations. He supposed they could take it for granted that Mr. Stenhouse's figures related to vertical retort tar alone, and not tar mixed with that coming from horizontal or inclined retorts. He was sorry Mr. Stenhouse had not mentioned the question of pitch and free carbon, as this was one of the principal differences between vertical and horizontal retort tar. The point was an important one, because the small quantity of free carbon present might have a very important bearing on the use to which the pitch was put.

Mr. F. Scholefield said the paper had proved most interesting, particularly in regard to the author's allusion to phenol. If it turned out that there was to be a shortage, he was afraid there was considerable trouble ahead.

Mr. Bailey remarked that Mr. Stenhouse's opinion was that it would be unfair to say too much at present on the subject of his paper, as vertical retorts were comparatively new. But he (the speaker) took the view that the members would appreciate the information the author was able to lay before them for their mutual benefit. It seemed to him (Mr. Bailey) that one part of the paper called for some reflection; for as the boiling-point went up, the specific gravity went down. This was contrary to ordinary distillation. He did not know whether it was possible—perhaps it was chemically possible—to separate the paraffin and the benzol constituents; but it would be very interesting if it were found by future work that coal heated at a certain temperature would give off paraffinoid bodies and benzol. With regard to the lecturer's suggestion [explained by means of a diagram showing continuous carbonization in a Glover-West installation] to "carry the shield further down," he thought there was a good deal in the idea. The subject was particularly interesting from the point of view of the coke industry, for it was well known that at the start of a charge, when the coal was cool inside the walls of the oven, they had very different results from those obtained five or six hours afterwards.

Mr. Hardern said he had not gathered from Mr. Stenhouse's paper any information as to the relative value of the two tars. Were they similar? It struck him that one particular tar—vertical or horizontal tar—might be found to be more useful for one purpose than another. If the percentage of free carbon—from 3 to 7 per cent.—were correct, it would appear that the vertical retort tar was much more valuable for road purposes than tar from horizontal retorts. Again, he gathered from the paper that the creosote oil remained much more fluid; and it occurred to him that this might have considerable advantage over that derived from horizontal retort tar.

Mr. Clayton said he gathered from the paper that vertical retort tar was of no greater value than that obtained from horizontal or inclined retorts. Mr. Stenhouse's experiences were useful to them as a Society, because he was interested in gas-works administration, and therefore his opinion was all the more valuable. One of the speakers had alluded to the presence of paraffinoid bodies in benzol—a subject of particular interest to aniline makers, although times had changed, and the quantity used to-day was relatively small; the greatest outlet for benzol at present being for motor purposes.

Mr. Stenhouse having briefly replied to some of the points raised in the discussion,

The Chairman said he was sure the members all agreed that the paper had proved of considerable importance, and they, as a Society, were fortunate in having had the first contribution on the subject. He moved a vote of thanks to Mr. Stenhouse.

Mr. Coleman seconded the motion, and it was carried.

Mr. Stenhouse thanked the members for the way in which they had received his paper.

THE FUTURE OF LIQUID FUEL.

Low Temperature Carbonization in Concentric or Annular Retorts, with Gas Evolved under Practically Complete Vacuum.

By F. D. MARSHALL.

[Reprinted from "The Motor," March 4.]

Scientists are now agreed, and even the man in the street is beginning to realize, that the present methods of treating coal for the production of gas or for steam raising must give way to more scientific and less wasteful methods whereby the valuable constituents of the coal can be more economically realized.

Hitherto the splitting-up of coal both in gas and coke-oven works has been effected at temperatures varying from 2000° to 2200° Fahr. So far as a large production of gas in the gas-works and a heavy production of coke from the coke-ovens are concerned, these temperatures are right enough; but when the economical production from coal of benzols and other oils suitable for liquid fuels is considered, then both coke-oven and gas-works practices must be abandoned.

The supply of benzol from gas-works will depend exactly on the quantity of tar they produce; and this bids fair to become stationary, as pushing retorts to higher heats may mean certainly more gas, yet the tar is deteriorated, and the benzols are destroyed. Only a fifth of the recoverable benzol series is found in the tar.

From gas-works gas the rich supply of benzol it contains (four-fifths of the total) cannot be eliminated without utterly ruining the illuminating power and reducing the same to "blue gas," which the various (and pernicious) Acts of Parliament will not permit. Thus, from gas-works tar we cannot hope, under existing conditions, for a larger supply of benzol. It is different with coke-ovens, as, the temperature of carbonization being lower, the tar yields more benzols and less anthracenes and naphthalenes; while, there being no great demand for illuminating coke-oven gas, the same can be washed with certain heavy oils for the recovery of the benzol it contains. It is clear, therefore, that under any system of high-temperature carbonization, the bulk of the benzols is found in the gas and not in the condensates.

But, for fuel purposes, there are even more valuable oils and spirits to be obtained from coal than those of the benzol or benzine series (termed the "aromatic" series). By varying the system of carbonization from a high to a low temperature, about 1000° Fahr., and with suitable retorts, not only can a fair proportion of rich gas and ammonia be recovered, but oil condensates, differing vastly from coal or coke-oven gas tar, inasmuch as they are of the paraffin series, which, on distillation, yield a spirit more approaching petrol than anything else, and scarcely contain a trace of benzine or naphthalene.

The gas, too, produced by low-temperature distillation will, on being washed by suitable heavy oils, yield a light spirit of great value. The resultant "blue gas" would be employed for partly heating the retorts. But, beyond this, the residue, or coke, is a fuel of great value, containing 86 per cent. of carbon, and from 5 to 10 per cent. of non-condensible high-intensity gases, so that the fuel ignites as easily as coal, burning with a smokeless flame free from soot or condensible vapours. The fuel is especially suitable for gas producers of the suction or pressure type, as it contains no condensible tarry gases which cause so much inconvenience when gasifying ordinary fuel for producer gas purposes.

What, however, we are immediately concerned with are the condensates or oils; and these can be obtained in quantities varying from 16 to 85 gallons per ton of coal. It is to these condensates we must turn as a source of home-produced liquid fuel. The process of treating coal under low temperature is the key of the situation.

Remarkable, too, is the fact that cannel coals—now almost a drug on the market—yield a large quantity of oil (80 gallons per ton), and the resultant coke is a most valuable fuel, differing from the residue of shale distillation, which is nothing practically but a useless ash. For a long time past the Premier Tarless Fuel Company have been busily at work solving the interesting problem; and we shall probably hear more about their business when the new and larger retorts are installed in a few weeks' time.

I may be broaching no technical confidence in stating that, in my opinion, the secret of the Company's success is not only the low-temperature distillation, but equally the highly-ingenious concentric or annular retorts, and principally, I think, the practically complete vacuum under which the gas is evolved from the coal—an enterprise never before attempted.

REGISTER OF PATENTS.

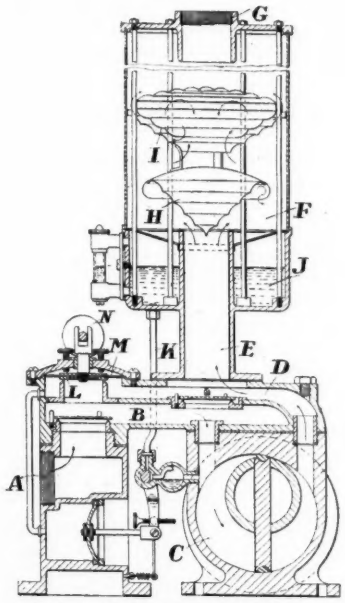
Plant for Compressing Gas.

PHILLIPS, C. W.; a communication from A. C. Roessler, of New York.

No. 23,487; Oct. 24, 1911.

This invention relates particularly to plant for compressing gas to be supplied to high-pressure gas-lighting systems.

In plant of this type as hitherto proposed, the patentee mentions, the compressor is placed within a suction chamber and delivers the compressed gas to a receiver, the pressure in which is regulated by a relief valve. A bye-pass valve is also provided, to admit the gas directly to the receiver from the suction chamber when the compressor is not in operation, while a non-return inlet valve prevents the compressed gas having any effect on the low-pressure gas-mains. His invention consists in a fluid compressing plant in which a relief valve, a bye-pass valve, and a non-return inlet valve are all placed within the same valve box.



Roessler's Gas Compressing Plant.

The illustration shows a sectional elevation of plant for compressing gas to be used in high-pressure gas lighting systems; the gas to be compressed being admitted through an inlet pipe A, the end of which forms a seating for a non-return inlet valve controlling the admission of gas to a chamber B within a valve-box. From the latter the gas passes to a compressor or blower C, which is preferably of the type described in patent No. 10,558 of 1907, and is driven by belting with the usual fixed and moving pulleys. From the compressor the gas is delivered into passages D E leading to a gas receiver F, from the outlet G of which the gas is supplied to the lamps of the system.

Baffles H I, arranged within the receiver, eliminate the impulses with which the gas is delivered from the compressor, and at the same time intercept and deliver into a reservoir J any lubricating oil coming over with the gas. The oil is then returned to the compressor through a pipe K. The relief valve, by which the gas pressure within the receiver F is regulated in accordance with the gas consumption, is preferably of the type having a float L, which closes a passage between the chamber B and the passage D, and is mounted upon a diaphragm M. The upper surface of the latter is subjected to atmospheric pressure, while the under surface, being in direct communication with the passage D, is subjected to the gas pressure in the receiver F. Screws passing through the valve cover contact with the upper surface of the float, and thereby enable the lift of the valve to be adjusted as desired.

The pressure at which the relief valve shall open is determined by the weights N, and the distance of them from the fulcrum of a lever which presses upon a knife-edged member attached to the float L, and projecting through the cover. It is thus possible, without interrupting the flow of gas, to adjust the pressure at which the relief valve shall open. When the pressure within the receiver exceeds a predetermined amount, the valve float is lifted off its seating, whereupon the compressed gas in the receiver passes into the chamber B. The non-return inlet valve over the inlet is thereby closed and prevents the further admission of gas to the plant until the pressure within the receiver has decreased sufficiently to allow the weighted lever to close the relief valve L.

If desired, one of the weights may be dispensed with, and the distance of the other weight from the fulcrum varied by providing within the lever a screw-threaded rod, which can be rotated to effect a movement of the weight along the lever.

Gas-Fires, and Burners Therefor.

GAYFORD, C., of Strand, W.C.

No. 10,838; May 7, 1912.

According to this invention, a gas-burner is arranged with a single outlet nozzle to direct a sheet of flame towards a forwardly inclined fire-brick back. The burner is characterized by a mouth or head set at an angle to the axis of the burner body or mixing chamber and arranged to deliver a sheet of flame uninterruptedly from a long, narrow slot forming the outlet from the burner mouth or head.

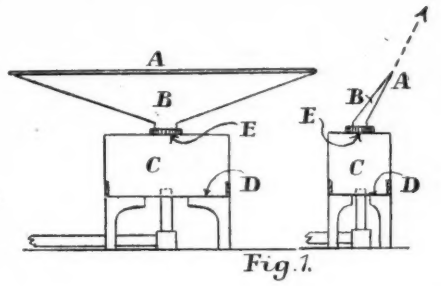


Fig. 1.

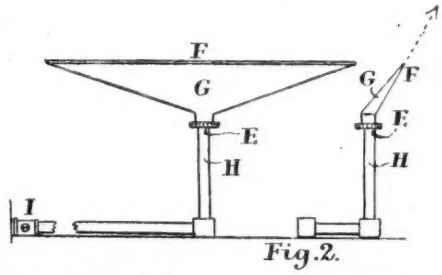


Fig. 2.

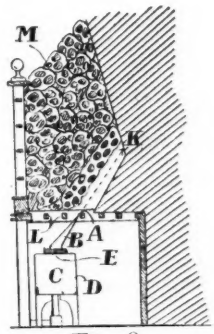


Fig. 3.

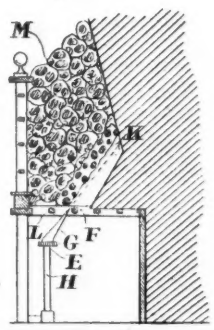


Fig. 4.

Gayford's Gas-Fires and Burners.

The first of two burners devised is shown in fig. 1. The final outlet of the burner is at the point A, where the ignition of the mixed coal gas and air takes place. The fine slit aperture is tipped with asbestos "so as to resist the corrosive effects of heat upon the metal of which the body of the burner is composed." The burner-head B is formed of sheet brass. In shape it is an irregular pyramid inverted. The two main sides, with their small ends, taper downwards from the slit outlet of the burner till they meet and form a circular opening. The inner surface of this opening is threaded; and into it the upper larger segment of the screw cap E is screwed. Thus the head of the burner

is brought into direct communication with the mixing-chamber C, which is a rhomboidal enclosed space. The outer walls and top of it are made of strong cast iron, and the top is perforated at the centre, with the perforation furnished with a brass threaded fitting into which the lower segment of the screw cap E is screwed. The floor D of the mixing-chamber is made of standard wire gauze netting securely fitted into the sides, so that no air finds ingress to the chamber except through its meshes. The wire gauze is of 28 linear wires to the inch, having 784 apertures to the square inch. The service pipe from the gas-main is brought into the mixing-chamber. Its terminal end is fitted with a nozzle of known size (provided with a single opening), so that the gas supply to the burners may be exactly calculated and regulated.

An alternative burner is shown in fig. 2. Here F is the outlet of the burner; and G shows the head of the burner, which tapers down to meet and screw on to the joint service pipe H by means of the screw-cap E. The air supply in this case is derived from openings in the joint service pipe at a point where the gas service pipe from the main furnished with one of the nozzles described above enters into the terminal of the joint service pipe. This is shown at I.

These joint service pipes are of the same kind as those used in all ring burners or gas cooking-stoves. But two extra provisions are added to the pipes, which require description. In the first place, the joint service pipe (which is so-called because it carries gas and air mixed to the burner) is of larger calibre than that which comes off from the main. It easily slips over the nozzle with which the latter is furnished, and is fastened by a screw union to prevent its slipping out of place. The large joint service pipe is perforated in two or three places around its circumference so as to admit air freely. In the second place, for the purpose of regulating the quantity of air used, the outer joint service pipe is provided with a circular shutter made from a section of a still larger pipe. This fits it accurately, but moves backwards and forwards easily so as to occlude partly or completely the holes by which air enters the joint service pipe which supplies the burner.

The connecting screw cap E, by which the burner heads are attached to the mixing-chamber in the one case and to the joint service pipe in the other, is really a form of adjuster screw used for the purpose of connecting pipes or chambers the apertures of which are of different sizes. In this case, the lower screw is the smaller one; the upper one, the larger. It is composed of two portions—each being a separate brass casting having on one side the shoulder which forms the screw, on the reverse a perfectly plane surface. The two plane surfaces are opposed to each other, and fit accurately. Between them a circular disc of wire-gauze netting is fitted so as to be securely gripped. The two castings are then brazed together. By the use of the gauze netting in this cap, back-lighting is effectually prevented.

Figs. 3 and 4 show sections of the fire-grates with the burners *in situ*. The flames impinge on the surface of the fire-brick back at the point K. L shows the transverse bars of the bottom of the grate in section; and M the grate packed with asbestos "the lower layer of which is composed of long bars cut to the length required, laid slantwise, so as to allow the flames from the burner to pass unobstructed to the fire-brick."

These are said to be the essential parts of the invention; and by it "the mixing of combustible volumes of coal gas and atmospheric air is brought about under conditions which admit of easy control and adjustment." The generation of heat and the production of very high temperature flames are also secured; while in this arrangement of fire-brick backs adjustable to any form of open coal-fire grate both the convection and radiation of the heat so generated are effectually accomplished.

If we regard light as luminous heat, the patentee concludes, and assume, as we are reasonably allowed to do, that both luminous and invisible forms of heat follow the same laws both in emission from their sources and transference to their surrounding media, then the following deductions are logical and irrefragable. Light is emitted in greatest intensity and effect at right angles to the plane surface of its source, and is also reflected in the most perfect manner in lines which run at right angles to the plane surface upon which its waves strike. Heat, in like manner, is most intense along lines drawn at right angles to the plane surface of its source (in the present invention the plane surfaces of the outlet of the burners); and its convection and radiation are both developed and given off respectively in greatest intensity at the plane surface on which its flames impinge, and at right angles to the plane. . . . "These are the aims studied in each successive stage of this invention; and the specification shows the methods by which those aims are to be attained."

Determining the Specific Gravity of Gases.

Dosch, A., of Charlottenburg, Germany.

No. 15,787; July 5, 1912. Convention date, July 5, 1911.

The inventor points out that a blade, wheel, or the like of a centrifugal fan and rotating in a casing filled with air or gas (which casing is wholly closed, or closed up to the inlet and outlet pipes) will occasion in the closed casing a vacuum at some point near the shaft and a super-pressure at a point near the periphery. The blade wheel will also suck the gas at a certain partial vacuum through the admission pipe and drive it along through the exhaust pipe, with the result that there will be a certain difference of pressure between the gas inlet and outlet. This partial vacuum, superpressure, or difference in pressure, presupposed a definite and known number of revolutions per minute of the blade wheel, will be dependent on the specific gravity of the gas.

This specific gravity is obtained according to the present invention if the measured pressure, or difference in pressure, is referred to the number of revolutions per minute and to a suitable uniform value which is obtained when using a gas of known specific gravity, presupposed the same number of revolutions per minute and otherwise identical conditions.

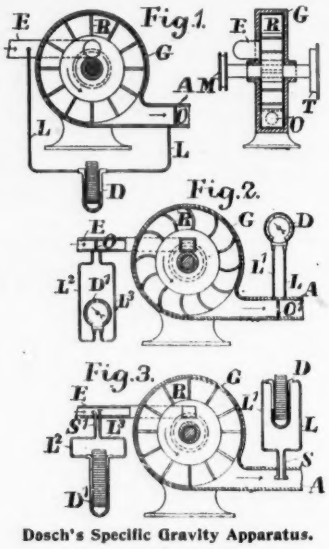
The pressure between the inlet and the outlet for an invariable number of revolutions per minute is proportional to the specific gravity of the gas. But instead of this, the velocity pressure of the flowing gas can be directly measured. The velocity of the gas at one spot of the inlet or outlet pipes will be invariable for otherwise identical conditions, whatever gas may be employed. On the other hand, this specific current or velocity pressure is:

$$p = \frac{k\,v^2}{2\,g}$$

in which p is the specific velocity pressure, k a coefficient, v the gas velocity, and g the earth acceleration.

By measuring this pressure p by means of suitable apparatus, there will be obtained in the manner stated above the specific weight of the gas, taking into consideration the number of revolutions per minute and the pressure produced by a gas of known specific gravity. Inasmuch as when using such a gas for a definite number of revolutions per minute of the blade wheel there also corresponds a definite statical pressure of the gas in a closed casing, or a definite velocity pressure in a casing through which the gas flows, so can the pressure from the second blade wheel, which has the same number of revolutions as the first, be utilized as value for comparison.

A few forms of construction are shown. In all the figures G or G^1 is the casing, R or R^1 the blade wheel, M the driving device, E or E^1 the inlet of the gas, A or A^1 the outlet of the gas.



Dosch's Specific Gravity Apparatus.

In fig. 1, the pressure difference in the inlet and outlet is measured by the gauge D, which is connected to pipes L and L^1, of any desired length. O is a constriction which, by making it of corresponding dimensions, permits of increasing the pressure difference. T is the apparatus for counting the number of revolutions per minute.

In fig. 2, the velocity pressure occasioned in the inlet pipe E and in the outlet pipe A is absorbed by throttling discs O^1 and O, and is measured by the pressure difference gauges D^1 and D, which are connected up by the pipes L^2 and L^3 and L and L^1 respectively.

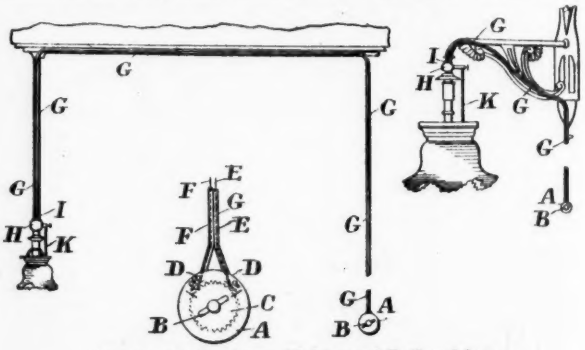
In fig. 3, instead of the throttling discs, the throttling devices S^1 and S are employed, which absorb the throttling pressure and transmit it to the gauges D^1 and D through the pipes L^2, L^3, and L, L^1.

Operating Gas-Taps from a Distance.

Kreutziger, W., of Bremen.

No. 22,121; Sept. 28, 1912. Convention date, Sept. 28, 1911.

In order to effect the lighting and extinguishing of a burner from some point of a room, the tap of the burner is often connected with an operating cable conveyed over rollers and in tubes, by means of which the tap is opened, while the closing of the tap is effected by a spring or a counterbalance weight. The employment of a spring on a gas-tap for this purpose could not, the patentee says, be relied upon for closing the tap "as it was impossible to guarantee the efficient action." His invention relates to regulating means in which the ends of a double cable



Kreutziger's Gas Lamp Lighter and Extinguisher.

are connected with the tap lever to be operated. According to the arrangement described, small toothed wheels are employed in the regulating switch casing, and also on the gas-taps themselves. Around the toothed wheels chains mesh in the same manner as the chain of a bicycle—that is, the chain lies around the chain wheel for the forward

movement of the wheels. The ends of the small chain portions are connected with the ends of the operating cable, which are enclosed in the usual way in small guide tubes. By this means the small wheels in connection with the gas-tap are caused to run in sympathy with the wheels in the regulating switch box.

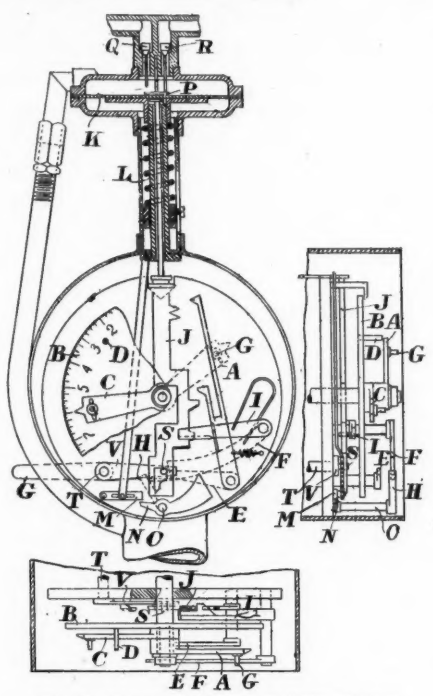
The arrangement and working of the switch are essentially as follows: In the regulating casing or box A is mounted a small toothed wheel which is furnished with a handle B. Around the wheel C a chain D meshes, the ends of which are connected with the ends of two flexible cables E F carried in small tubes G from the regulator to the toothed wheels H on the gas-tap. Around the wheel is also arranged (so as to mesh) a chain I, the ends of which are firmly connected with the cables E F. Upon turning the wheel C to the left by the handle (that is, to the indication "on"), the wheel H on the gas-tap also turns and correspondingly opens the gas-tap, so that gas can flow out and be ignited by the bye-pass. The gas for the bye-pass is carried through a small tube K connected to the gas-pipe above the toothed wheel. If, now, the handle B is turned to the "off" position, the gas-tap will be closed and the flame of the burner extinguished.

Automatic Lamp-Lighting and Extinguishing Devices.

BRÖNDUM, M. V., of Aarhus, Denmark.

No. 16,545; July 15, 1912.

This device is operated by clockwork for automatically lighting and extinguishing, at predetermined times, a plurality of lamps, and is illustrated (as applicable to gas-lamps) in front view, sectional side view of the lower part, and sectional top view.



Brondum's Lamp Lighter and Extinguisher.

The *modus operandi* is as follows: The arm A is adjusted relative to the dial B in conformity with the time at which it is desired to light the lamps; and the arm C is similarly adjusted with regard to the time at which the lights are to be turned out. The stud D is disposed on the dial B in such a position as to contact with the levers E at a time of the night when half the lights are to be turned out. The elements have initially the position shown; but as the arm A moves round with the dial B, between the levers EF, the former lever will in due course be engaged by the stud G and turned into engagement with the catch H, which retains it in actuated position. The arm I participates in the movement of the lever F, and its rib snaps under the shoulder of the push-bar J. From the disengagement of the stud G from the upper edge of the lever F till the stud arrives at the catch H about three-quarters of an hour elapses, during which time, if a premature lighting of the lamps should be required, this can be effected by an increase in the gas pressure. At such an increase in pressure, the diaphragm K will be actuated and the tube L depressed in opposition to the spring shown. The movement of the tube is transmitted by a rod to the lever M, which engages the arm N and turns the shaft O, together with the catch H, so as to set the lever F free. Under the influence of the spring, the arm I then turns and lifts the bar J, together with the rod and disc attached to it. The latter engages the diaphragm K and lifts the disc P, together with the two valves Q R; gas being thus admitted into the conduits, and all the burners set alight.

If no premature lighting is required, the apparatus is left to light the lamps automatically, which it does when the stud G arrives at the catch H; the latter being turned by the stud to set the lever free.

In order to allow the gas to be turned on and off by hand at any time independently of the clockwork, a stud S is mounted on an arm connected to a shaft T. This shaft carries a hand-lever U, which projects out of the casing and which can be locked in the position shown, so as to secure the shaft against rotary movement. By means of this hand-lever, the arm V can be turned for raising or lowering the bar J, thereby opening or closing the valves.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Abandoned Coal Export Tax.

SIR,—From the rejoinder of Mr. Charles Carpenter, in the last number of the "JOURNAL," to my letter to you of the 19th ult. [*ante*, p. 551], it appears that he looks in two directions for help in getting a reduction in the prices of coals: (1) An appeal to the colliery owners "not to," as he puts it, "strain too greatly the advantage their monopoly gives them;" (2) an appeal to Parliament to keep coal prices down. Perhaps you will allow me to comment briefly upon these, in order to examine whether there is anything in them likely to arouse the sympathy of an impartial business man?

(1) It does not affect the question whether or not colliery owners have a monopoly. I know of no monopoly possessed by any colliery owner beyond one of working certain circumscribed areas for the purpose of winning coal. He has no monopoly when he comes to the selling of that coal. There is no combination existing or likely to exist among colliery owners to fix prices. Anyone with an experience on the Newcastle Exchange can tell of the keen competition, the agile rush-to-be-first and the fear of undercutting, which are in evidence as soon as a contractor (be he Briton or foreigner) appears likely to buy. Prices are fixed and regulated by the law of supply and demand. If the colliery owner makes big profits, he soon has competitors sinking new pits, the outputs of which compete with him, or he drives the gas companies to use a larger proportion of oil. I therefore venture to submit that the first of Mr. Carpenter's two appeals is superfluous and unnecessary.

(2) The appeal to Parliament. A desire to check the export of British coal is based on the assumption that the coal which is sent abroad would be available for home consumption, whereas the Royal Commission on Coal Supplies found that this was not the case, and that the geographical position of certain collieries necessitated the export of their coal. If the export of coal were prohibited, these collieries could not work at a profit, and the result would be disastrous both to the capital and the labour engaged in them. It is true that our existing supplies of coal cannot be replaced; but the quantity exported is only one-fifth of the total produced, and whether we work out our coal at the rate of 300 million tons per annum or at the rate of 240 millions per annum will not affect the position in this island for the next three or four centuries. If the argument were sound when applied to the one-fifth, then it would also be sound to apply it to the five-fifths, and we had better keep our coals. Till when? In my previous letter, I said it would be an unfair thing if taxation were made a lever to depress one British industry for the benefit of another British industry; and undoubtedly Mr. Carpenter would recognize that the abandoned coal export tax did this, and benefited the gas companies at the expense of the colliery owners, or why does he seek to have it reimposed? Let us hope that the day is far distant when Parliament will be called to adjudicate between the interests of rival British industries.

I submit that Mr. Carpenter's second appeal is unfair to the coal industry, and dangerous as an industrial weapon.

March 6, 1913. COAL FITTER.

LEGAL INTELLIGENCE.

EAST SUSSEX GAS AND WATER COMPANY.

Position of Debenture Holders.

Last Wednesday, Mr. Justice Swinfen Eady heard the further consideration of an action by Mr. Bowman, a debenture holder, against the above-named Company. Mr. Ward Coldridge, K.C. (with him Mr. Wilmot), said the action was commenced in July, 1909, and Mr. Brown was appointed Receiver and Manager. The statement of claim was delivered, and subsequently an order was made for the usual inquiries to be instituted and the accounts taken. In 1910, an action which went to the very root of the debenture holder's claim was commenced by the Ticehurst Water Company with regard to the supply of water by the East Sussex Company at 6d. per 1000 gallons, and Mr. Bowman and the Company were made defendants. The action, however, was dismissed with costs, which were subsequently taxed at the sum of £306. On May 24, 1911, a certificate was filed showing that 998 debentures of £10 each were outstanding, and interest had been computed on the debenture debt to March 25, 1909, and a sum was deducted for income-tax. On Oct. 24, the gas portion of the undertaking was sold for £1600; and this sum had been paid into Court. In April, 1912, application was made for leave to sell the water portion by public auction. But nothing came of this; and the Receiver and Manager continued, at his own risk, to carry on this branch of the concern until August, 1912, when he succeeded in selling it by private contract for £1750, and the sale was duly completed. These two sums comprised the whole of the assets, as the inquiry showed that the uncalled capital would not realize anything. The minutes provided for the discharge of the Receiver and Manager, the taxation and payment of costs, including the costs of the Receiver in tracing the Company's title to the land on which the works were situated. He found that the Company had no title deeds or conveyance, that the fee-simple of the land was vested in the name of one Eaton, subject to a mortgage for £500. As a result of the work done by the Receiver, he succeeded in getting a conveyance of the land without any payment. His Lordship made an order as asked; and, in reply to a question, Mr. Coldridge stated that the debenture holders would receive a dividend of about 5s. in the pound.

MISCELLANEOUS NEWS.

TRANSFER OF SIDMOUTH GAS AND ELECTRICITY UNDERTAKING.

The Award in the Arbitration.

At a Special Meeting of the Sidmouth Urban District Council last Wednesday, the Chairman (Mr. T. Kennet-Were) announced that the amount of the award for the purchase of the undertaking of the Sidmouth Gas and Electricity Company was £34,683.* He thought he could honestly claim that the award was a favourable one. Mr. Halse said they were perfectly satisfied that the purchase would prove remunerative for the Council, and a very fine thing for the town in general. There were three other things to be estimated—viz., the amount of compensation to be paid to the officers of the Company, the costs connected with the arbitration, and the Company's costs for the promotion of their Bill. These were estimated at £2500, and the other costs at £6617. The Council had put the total amount at £41,400. The money could be borrowed under the Act, to be repaid in thirty-five years. The Council's costs for promoting the Bill were estimated at £1600; so that the total amount was approximately £43,000. This sum could be borrowed at 3¼ per cent.; so that the annual repayment of principal and interest would be about £2175. The repayment of the £1600 was spread over a period of five years; and the annual amount would be £375. So that the total yearly payment would be £2550. The Committee, therefore, had every confidence that they would not have to ask the ratepayers to contribute a penny in rates; and in a very short time they hoped to take money from the profits to relieve the rates. Thanks were accorded to the Committee, especially to Mr. Halse and Mr. Budd, for conducting the negotiations on behalf of the town; and an acknowledgment was also made to the Umpire, Mr. A. J. Ram, K.C.

* The proceedings in the arbitration were reported in the "JOURNAL" [See *ante*, pp. 198, 262.]

WAGES AND HOURS AT THE GRANTON GAS-WORKS.

The Edinburgh and Leith Gas Commissioners, on the advice of their Engineers (Mr. W. R. Herring and Mr. Masterton), have recently had under consideration the rates of wages to be paid to the different classes of men in their employ; and in the following table are the rates which are now being paid. In addition, the men are carried to and from the works, by rail, free of charge.

Statement Showing the Current Rate of Wages at the Granton Works, &c., together with the Last Increases Granted.

Class of Workmen.	Hours per Week.	Rate per Hour.	Rate per Shift on Day.	Amount of Increase Granted per Week	Total Wages.
Granton Division.		Pence.	s. d.	s. d.	s. d.
Chargers	56	..	5 7	1 9	40 0
Drawers	56	..	5 7	1 9	40 0
Producer men	56	..	5 7	1 9	40 0
Leakmen, greasers, water and hydraulic main attendants	56	..	4 8	2 4	33 5
Conveyor and breaker attendants	56	..	4 8	2 4	33 5
Enginemen	56	..	4 8	2 4	33 5
Boilermen	56	..	4 8	2 4	33 5
Trimmers	56	..	4 4	2 4	31 0
Yard labourers	51	6	4 6	2 1½	25 6
Gasholder and messroom attendants	56	..	4 0	2 4	28 7
Locomotive drivers	56	..	5 0	2 4	35 9
Shunters	56	..	4 4	2 4	31 0
Cranemen	56	..	4 8	2 4	33 5
Purifier men	51	7	5 3	2 1½	29 9
Residual products men	56	..	4 8	2 4	33 5
Mechanics, handymen, and labourers	51	6½	4 10½	2 1½	27 7½
Pipelayers and jointers	51	8	6 0	2 1½	34 0
Brassfinishers	51	7½	5 7½	2 1½	31 10½
Masons	51	9	6 9	—	38 3
Bricklayers	51	9½	7 1½	—	40 4½
Painters	51	8½	6 4½	2 1½	36 1½
Joiners	51	9½	6 11½	2 1½	39 4
Blacksmiths	51	8	6 0	2 1½	34 0
Fitters	51	8½	6 4½	2 1½	36 1½
Turners	51	8½	6 4½	2 1½	36 1½
Edinburgh and Leith Division.					
Gas-fitters	51	7½	..	—	31 10½
,, labourers	51	5·68	..	2 1½	24 1½
Main layers	51	7½	..	—	31 10½
Service layers	51	7	..	—	29 9
Main and service labourers	51	6	..	2 1½	25 6

Note.—Mechanics rates are those of permanent hands. The amounts shown for all men on shifts in "Total Wages" column includes the extra for Sunday work. Overtime is paid at the rate of time-and-a-quarter up to 10 p.m., and time-and-a-half afterwards. Time-and-one-third for Sundays.

There is a superannuation scheme, to which the men are required to contribute at the rate of 2½ per cent. on their wages, the Commissioners contributing a like sum. The men are entitled after forty years' service to two-thirds of their wages as superannuation allowance, and *pro rata* for shorter periods.

THE TRURO GAS COMPANY AND THE ELECTRIC LIGHTING SCHEMES FOR THE CITY.

Board of Trade Inquiry.

At the Board of Trade Offices, Whitehall, last Wednesday and Thursday, Mr. GARNHAM ROPER, Assistant-Secretary in the Harbour Department of the Board of Trade, held an inquiry with regard to the Electric Lighting Provisional Orders for which applications have been made by the Truro Corporation and the Truro Gas Company.

Mr. W. E. TYLDESLEY JONES appeared for the Gas Company; Mr. W. W. SZLUMPER represented the Truro Corporation.

Mr. SZLUMPER, in opening the case for the Corporation, said the question of electric lighting had been before the Corporation for a considerable time; and they had made very considerable inquiries before coming before the Board of Trade on the present occasion. At the time the Gas Company's Order was applied for, the Corporation had not finally decided their course of action; but since then, although not altogether by reason of having their hands forced by the Gas Company, they had decided to go on with the matter, and, if their Order was granted, to carry it out. They had taken the advice of Dr. Purves, an electrical engineer who had had considerable experience of undertakings similar to that which would be set up in Truro; and his estimate was that for £8000 an installation could be furnished which would provide for the whole of the needs of the city. As a fact, there was no opposition to the Corporation Order, because, although it was perfectly true that the Gas Company were before the Board of Trade, they were not opposing the Corporation Order, but would say that it was in the best interests of the city that the electric lighting should be in their hands and not in the hands of the Corporation. As a matter of fact, however, it had been the almost invariable practice of the Board of Trade not to place electric lighting powers in the hands of gas companies. He personally, as an advocate, had lamentably failed on several occasions in impressing the view upon the Board of Trade that Orders should not be granted to municipalities by reason of gas companies' opposition. The Gas Company's application was for an area co-terminal with its existing gas limits, which extended beyond the city boundaries; but there was no demand for electric current outside the city itself, as the area was purely agricultural, and there was only one mine which could be regarded as a possible consumer. This was three miles beyond the city boundary; and at present it had its own electric plant. Further, the Cornwall Electric Power Company could supply in the whole of the area outside Truro, although, if a considerable demand arose during the next few years, the Truro City Council would be quite prepared to come to the Board of Trade for extended powers. One of the arguments of the Gas Company in their favour was that they could, to a large extent, use their own staff for the electric lighting undertaking. Experience, however, proved that if a gas company did have electric lighting powers the staff would have to be nearly doubled; so that there was no economy from this point of view. As to profits, the Corporation could run the undertaking on a much smaller margin of profit than the Gas Company would want to do; and there was every danger of the electrical undertaking not being properly developed in competition with gas if the two concerns were run by the same people. Finally, Counsel referred to the Winchester clause, which provides that the charges shall be so fixed as to meet expenditure. It appeared that when the Order was first drafted, the Corporation's Parliamentary Agent recommended the insertion of the clause, as he thought it would possibly tend to lessen the force of any argument put forward by the Gas Company; but the Council, in Committee, decided to delete it, and at present it is not in the Order.

The *Mayor of Truro* and the *Town Clerk* were then called in support of the Corporation's application, and said in their opinion the citizens as a whole were most definitely in favour of the Corporation having the powers. This point was cross-examined upon by Mr. Tyldesley Jones, who brought out the fact that the whole of the proceedings of the Corporation in regard to electric light in Truro had been carried out in Committee, and that, officially, at any rate, no information had been given to the ratepayers, and that they had never been called upon to express any opinions with regard to it. At the last elections, it did not form a very "live" topic, as in every ward the Councillors were returned unopposed. Counsel also sought to bring out that building operations in Truro were to a large extent unimportant, and that the only prospects for an electric lighting scheme would be to displace gas. With regard to the reasons which prompted the Corporation to take active steps in the matter of electric lighting, the Mayor put it somewhat higher than his Counsel, and agreed that the application for a Provisional Order was lodged through the action of the Gas Company in applying for an Order.

Dr. *J. A. Purves*, a consulting electrical engineer of Exeter, stated that he had acted for 25 undertakings of a similar character to that which would be required for Truro. He first reported with regard to Truro in 1911, on behalf of a company who proposed applying for an Order. In his opinion, Truro offered an exceedingly good field for the establishment of electricity works. His first report to the Corporation showed a profit of £250, after allowing £300 revenue from public lighting. It was then pointed out to him that the present cost of public lighting was only £142; and he subsequently amended his estimate so that the amount of public lighting should not exceed the present cost, with the result that the estimated profit after the first year was reduced to £92, which he regarded as a very good result for the first year of an undertaking. The estimate for public lighting was for an equivalent amount of light now given under the gas contract. He agreed that there would be no advantage, *quâ* light, in substituting electricity for gas for precisely the same candle power. His only object in amending his report was to keep the cost the same as at present. The existing lamps are 60-candle power per post. If electricity were substituted, he would use time switches on the lamps and not lay special lighting mains. If there was any possible advantage in electricity for lighting, it might be in the fact that the incandescent gas-mantle did not retain its luminosity for the same length of time as did a

metallic filament lamp, and there would in consequence be extra cost for renewals. The total estimated cost of the scheme came out to £8000; and the equipment would consist of two 100 H.P. gas-engines with suction-gas plant, and two 65 kw. generators, which it was estimated would meet the requirements for three years. The system would be three-wire, and of 220 and 440 volts. At the end of the first year, it is estimated there would be 3500 40-watt lamps in use; and the total revenue was put at £1152 for the first year—the basis of revenue per private lamp being 10 units per lamp per annum. Many smaller towns with which he was connected had a much larger consumption than this at the end of the first year. The total costs, including capital charges, were put at £1060—thus showing a net profit of £92.

Mr. TYLDESLEY JONES cross-examined witness at considerable length on his estimated figures, and challenged the 10 units per lamp per annum for private use. He also brought out the fact that the estimates were on the basis of 100 consumers, which showed that each consumer would have an average of 35 30-watt lamps, which it was suggested was enormously high. Witness, however, maintained to the contrary. Counsel also put it that, in order to fulfil the estimates, one-eighth of the existing houses in the town would have to adopt electricity immediately. Witness admitted that when reporting to the private company to whom he had referred, he used practically the same figures as those given to the Corporation in his first report, which showed a profit of £250; yet the Company decided that it was not a sufficiently attractive proposition to continue with, and the scheme was allowed to drop. Another point brought out in the cross-examination was that the chief engineer would receive a salary of £150 per annum, and would be required to do all the clerical work in addition to such work as main repairs; while the assistant engineer would receive a salary of £50 per annum, and his duties would include such work as cleaning public lamps, connecting up house services, &c. All the mains would be laid underground. Counsel argued that the capital expenditure allowed for this—namely, £2200—would be inadequate, and suggested that in no similar town had a similar mileage of underground mains been laid for such a price. The average price assumed in making up the revenue account was 6d. per unit for lighting, and 3d. for power and heating. The revenue from the latter source has been put at £75; but the evidence was to the effect that various promises had been made which would justify it being increased to £150 in the first year. Some months ago, Dr. Purves read a paper at Exeter before a conference of gas managers, in which he strongly advocated the combination of electricity works and gas-works in small towns. Counsel drew attention to this; but witness still adhered to what he said in the paper, but now applies his remarks to corporations as well as gas companies.

A number of town councillors were then called, who spoke as to having canvassed the town in a private capacity, and discovered an almost unanimous feeling in favour of electricity. It appeared that many people using gas-engines at present for power purposes had expressed the opinion that if they could get electricity at an equivalent price to gas at 1s. 6d. per 1000 cubic feet they would have it. This, said Counsel, would have to be 2¾d. per unit. Incidentally an opportunity was found for complaining as to the quality of the gas supplied by the Gas Company; but similar complaints could be made about every gas company, and no real importance could be attached to them. One of the witnesses called for the Corporation was Mr. J. E. Webb, a county councillor, and a shareholder in the Gas Company, who expressed himself against a double monopoly being in the one hand. His cross-examination, however, as to the practical effect of the so-called Gas Company's monopoly, hardly strengthened his evidence.

The Gas Company's Case.

Mr. TYLDESLEY JONES, on Thursday, dealt with the case for the Gas Company, both as regards the opposition to the Corporation Order and in support of the Company's own Order. He commented upon the difference in the usual circumstances in such cases as the present, because the Gas Company were not saying that there should be no electric light for Truro; on the contrary, they admitted that it was desirable that a supply should be available. He thought, however, he could show special circumstances why the supply of electricity should not be placed in the hands of the Corporation. In the first place, it should be regarded as essential that there should be no charge on the rates; and he submitted that, from his criticism of the estimates put forward by Dr. Purves, there was every probability of the ratepayers having to meet a deficit. Again, supposing the undertaking would not be a charge upon the rates, the circumstances under which the Corporation had promoted their Order—merely in the spirit of desiring to keep out the Gas Company, after the latter had taken the initiative—should be seriously regarded by the Board of Trade in considering the matter. Truro had been provided with gas since 1820; the Company being composed of local gentlemen who had the interests of the city at heart, and were not a body of promoters merely wishing to make money out of the city and having no other interest in it. The Company last year could have paid 5⅜ per cent. dividend, but contented themselves with 5 per cent. As another instance of their interest in the town, he mentioned that during the coal strike the Directors offered a portion of their stock of coal to local consumers; and further, though they had been offered £1 per ton for their coke more than the ordinary prices by persons outside the city, they had refused the offer and decided to sell to local users at ordinary winter prices. He characterized the Corporation's application as one of the most hasty promotions by a local authority that had ever come before the Board of Trade, and emphasized the point that there was no ratepayers' opposition to the Gas Company's application. He contended that on the facts which had been put forward by the Corporation, even if the Board of Trade refused to grant the Gas Company's Order, they ought to refuse the Corporation Order. The prospects for electric supply in Truro, he said, were well shown by the fact that in twenty years there had only been an increase of 194 in the population, and, generally speaking, the town was by no means a progressive one—no new industries or new factories having been built for many years. The only hope for an electrical undertaking was to instal electricity in houses now having gas; and the result would be that practically all the consumers who would be obtained would be on the mains by the end of the first year, as those able to afford electricity would change over at once. After this period, the progress of an electrical undertaking in a place like Truro would be exceedingly slow. With regard to Dr. Purves' estimates of capital expenditure, the only place now in the United Kingdom that he could find with an electric undertaking where the population was at all comparable to that at Truro was Northfleet. The capital expenditure there was £8162; but the important point to be remembered was that at Northfleet there is no generating station. Engineers' estimates were invariably exceeded. This being so, with the very small margin of profit shown in the first year by Dr. Purves, it could be seen how easily this could be turned into a loss, and a slight modification of any of the items would bring this about. As examples, he mentioned that the Chief Engineer's salary of £150 per annum must be inadequate, and, again, the figure of 10 units per lamp was much too high. There were only 304 houses in the compulsory area; and Dr. Purves had estimated for 100 consumers. The only comparable place he could find in this respect was Carmarthen, where the units per lamp per annum were 4. Taking the figure of 4, this would reduce the revenue from private lighting by no less than £520; and having in mind the admission of Dr. Purves that the 100 consumers was not based upon any definite information, this result might easily be obtained. Again, the figure included in the Corporation estimates of £142 per annum for public lighting was wrong, as the public lighting in the compulsory area only cost £120. The estimate of £75 for cooking and heating was the wildest guess; and there was nothing to substantiate it anywhere. Electric cooking had not "caught on" elsewhere; and there was not much likelihood of it doing so in a place like Truro. With regard to the promises of consumers who would take power to the extent of their present bills—namely, £150—he pointed out that in all cases these consumers were taking gas for lighting as well as power, and the figure of £150 referred to included lighting. Finally, in opposition to the Corporation Order, Counsel remarked that the Gas Company were vitally interested, as ratepayers, in seeing that the scheme was not carried out. In the event of the Corporation getting their Order, however, he urged the Inspector to insert the Winchester clause. In support of his own Order, Counsel emphasized the advantages accruing from the combination of an electricity undertaking with a gas undertaking in small towns—a policy which Dr. Purves himself had approved. At Truro, the Gas Company had the land and practically all the buildings necessary; and in installing gas-engines for driving the generators, the Company would have a new customer for their gas, and any loss in gas revenue from consumers changing from gas to electricity would be compensated for in the electricity revenue. Furthermore, the Gas Company had practically all the staff that would be necessary to carry on the electricity undertaking. As precedents, he mentioned Ascot, Brixham, Bishop's Stortford, Farnham, and Bognor (among others) as statutory gas companies owning electric works; and recently the Board of Trade had authorized the transfer of an electric lighting Order to the Holsworthy Gas Company. At Ascot, Brixham, and Farnham, the companies had exercised their electricity powers, and at Bognor a generating station was being constructed.

Mr. *S. J. Ingram*, the Engineer and Manager to the Truro Gas Company, gave evidence in support of the Company's Order. The estimated capital expenditure was £7535; and from a revenue account which he put in it was shown that after five years' working there would be a profit of £494, subject to an allowance for depreciation. These estimates had been prepared in conjunction with Mr. Brooks, of Ascot. The number of consumers whom he thought it would be likely they would eventually get in the compulsory area, having regard to the property now existing, he put at 157. The Company already had the staff for dealing with laying mains, accounts, business getting, &c., and the existing show-rooms would also be available for electricity purposes—there being ample room.

Mr. SZLUMPER did not cross-examine at any great length; his main point being that no allowance was made in the estimates for any increase in the present salary of Mr. Ingram by reason of the additional work which he would have to do in looking after the electricity undertaking. As a matter of fact, the estimates included £50 as a proportion of Mr. Ingram's existing salary; but the point as to his future remuneration had not been settled. In any case, the proportion chargeable to the electricity undertaking would not be varied.

Mr. *A. E. Brooks*, the Engineer and Manager of the Ascot and District Gas and Electricity Company, was called to give evidence as to the success which has attended this combined undertaking. Curiously enough, he said, the supplies of gas and electricity in Ascot were going up by leaps and bounds—the one not seeming to affect the other. Nearly 50 per cent. of the electricity consumers also took gas; and it had been found possible to reduce the price of gas since the supply of electricity had been commenced. From his experience at Ascot, he doubted whether at Truro anybody but the Gas Company could make an electricity undertaking successful. He strongly contested the number of lamps per house estimated in the Corporation figures—viz., 35—and also the number of units consumed per lamp per annum (10). At Ascot, the number was about eight for the latter figure.

Mr. SZLUMPER'S cross-examination was quite brief; and although he had the right of a final reply, he did not exercise it. In answer to the Inspector, however, he stated that the Corporation would, in the event of their Order being granted, agree to the insertion of the Winchester clause.

The proceedings then terminated. The decision will be made known in due course.

South Hants Water Company.—The report presented by the Directors of this Company at the meeting of shareholders last Friday week showed a sum of £18,188 carried to the profit and loss account, the total of which was £18,776. The maximum dividends were recommended, which would absorb £13,806. A distribution of £1335 from the back-dividends fund was suggested—giving 2s. per share on the 10 per cent. shares, 1s. 4⅘d. per share on the 7 per cent. shares, and 1s. 1⅗d. on the 5 per cent. shares. The Directors stated that they had entered into a provisional agreement for the purchase of the undertaking of the Bishop's Waltham Water Company, Limited; and the shareholders were asked to confirm it. The report was adopted.

ILKESTON GAS-WORKS DISCLOSURES.

Mr. F. C. Humphrys' Position.

[From Our Local Correspondent.]

Despite very strong protests entered at the meeting of the Ilkeston Corporation, last Tuesday, as to the unfair treatment to which it was alleged that Mr. F. C. Humphrys, the Gas Engineer and Manager, had been subjected, following upon recent disclosures at a Local Government Board inquiry, the majority of the Council persisted in the decision to accept his resignation of the control, and to appoint him to the position of Assistant-Engineer, at the reduced salary of £150 per annum. The discussion threw a strong light upon the circumstances under which Mr. Humphrys was induced to tender his resignation; the plea in defence of the action of the Committee being that, after what had fallen from the Inspectors, no other course was possible. But the consideration was strongly emphasized that it was the members of the Gas Committee who held office at the time upon whose shoulders the liability should really be placed, and that the Engineer, having simply carried out instructions, had been ungenerously allowed to accept vicariously the responsibility which belonged to others.

The feeling of the Council was tested upon an amendment (moved by Councillor Smith) to the Committee's report, which recommended that the resignation should be accepted, and that Mr. Humphrys should be appointed, subject to agreement, as Assistant-Engineer, at the reduced salary mentioned, as from the date of the commencement of the services of a new Manager—Councillor Smith proposing that this part of the report should be deleted, and that Mr. Humphrys should be permitted to retain his old position. The amendment naturally opened the way to a revelation of the circumstances connected with a very unpleasant business; and, although the report was eventually adopted, there was not wanting evidence of a serious concern as to the turn matters have taken—the view expressed by two prominent members that the less that was said about the matter the better, indicating that the desire was apparent in most quarters that the whole business should be as quickly as possible forgotten. Whether, however, the Local Government Board will exactly acquiesce in this arrangement, is a matter in relation to which developments will be watched with considerable interest. Meanwhile, of course, the object has been temporarily served, although Mr. Smith, in ventilating the question, did not hesitate to apportion the blame in the ratio in which, according to his view, the occurrences warranted. His main point was that the contract for the steel tank and holder had been let for £5086 six weeks before the Local Government Board inquiry was held in respect to the loan in 1898; and yet the plans placed before the Inspector were for the brick and puddle bank, estimated to cost £9041—the net result being that the Corporation became possessed of nearly £4000 more than they knew the work would cost. He mentioned the names of several members of the Committee who were present when the contract for £5086 was allocated, and who also attended the inquiry when the application for sanction to borrow the larger sum was made, including Alderman Beardsley, the Chairman of the Gas Committee, and Mr. Walter Tatham, the Vice-Chairman. These and two other gentlemen, he asserted, were directly "in the know." It had been said to be a "mystery" why the Local Government Board had not been apprised of the alteration of the plans; but Mr. Smith declared that previous to the inquiry Mr. Humphrys was given orders that he must not, under any circumstances, permit it to be known to the Inspector that wrong plans were being presented.

The Mayor (Councillor F. P. Sudbury) said that, as a member of the Committee at the time, he did not think that Mr. Smith was correct in making such a statement. It ought not to go forth to the public that this was an accurate record of what occurred at the period. Mr. Smith said he deemed it his duty to say what he could in favour of the Manager; and he looked upon what he had stated as being in Mr. Humphrys' favour. He contended that there was confirmation of what he had said in that which was stated by the Vice-Chairman of the Gas Committee, Mr. Tatham, at a meeting of the General Purposes Committee a fortnight since, when he said he was present at the time the instructions were given to Mr. Humphrys. The "trump card," Mr. Smith added, which seemed to be relied upon for Mr. Humphrys' humiliation, was what was said by the Inspectors at the late inquiry. Having, however, been himself present, he unhesitatingly avowed that nothing which was uttered by the Inspectors warranted the present position of affairs. All they asked was that the matter should be brought before the Council. They did not suggest for one moment that Mr. Humphrys should discontinue to hold the position of Manager. It had been suggested, in the interest of the Committee, that the inquiry clearly showed that it was not the Committee who were at fault; but he contradicted emphatically this view of the matter. It was very unjust that the whole blame should be placed on Mr. Humphrys' shoulders, and that he should alone have to bear the brunt. He felt very strongly that a man who had grown grey in the service of the Corporation deserved every possible consideration.

The amendment in favour of Mr. Humphrys being allowed to retain his position as Manager having been duly seconded, Alderman H. Moss said they were all in agreement with Mr. Smith as to their respect for Mr. Humphrys. It would put every member of the Council about that he should have to send in his resignation; but he did not think it would help Mr. Humphrys to thresh out the matter any longer. He was willing to take a subsidiary position; and it was their duty to stand by him, without prolonging the discussion. Mr. Woolley invited the Chairman and Vice-Chairman of the Committee to reply to Mr. Smith's serious statement that Mr. Humphrys was given orders not to say a word at the inquiry. Alderman C. A. Sudbury also expressed the view that the less that was said about the matter the better. They were all sorry that Mr. Humphrys should be placed in this position; and they had done their very best to make his path as smooth as possible.

Alderman Sudbury said there were no fewer than four gentlemen who heard what was stated at the inquiry. There was no necessity to regard the matter, as had been suggested, as "backstair" evidence. The simple fact was that the Inspector asked the Mayor to bring the question before the Council, and to deal with it as quickly as possible. What he said left no doubt, but was sufficiently plain to induce them to take the action they did. In company with his brother, he saw Mr. Humphrys, and placed the whole of the facts before him; and when they had talked the matter over, Mr. Humphrys said he would hand in his resignation. Mr. Macdonald, as a member of the Gas Sub-Committee deputed to deal with matters arising out of the explosion at the works last year, questioned Mr. Smith's authority to speak for Mr. Humphrys in the way he had done. If he believed that Mr. Humphrys influenced Mr. Smith, he would certainly have deemed it his duty to bring forward information which would have done Mr. Humphrys harm [Cries of "Shame"]. In view, however, of the fact that Mr. Humphrys was well satisfied with the arrangement which had been made by the Committee, and that some of his friends had suggested that the best thing would be to "let sleeping dogs lie," he (Mr. Macdonald) did not think it requisite to say anything to put these matters right. Mr. Mitchell said he was at a loss to understand how the amended plans were submitted after others had been forwarded and approved by the Local Government Board. He could not think that Mr. Humphrys would have taken it upon himself to present these plans without the Committee being aware of what he was going to do. The Mayor said that Mr. Mitchell was a little wrong in his surmise. The plans had not been approved by the Local Government Board. Alderman Beardsley, the Chairman of the Gas Committee, said that on the occasion of the inquiry, he thought that everything was being carried out with perfect legality and regularity. He was quite ignorant himself of anything wrong being done. He felt sorry, and should have been pleased personally to do anything, if possible, so as to reinstate Mr. Humphrys.

Mr. W. Tatham, the Vice-Chairman of the Committee, said he did not seek to excuse himself regarding the matter, because he thought he was in a similar position to Mr. Humphrys, and that every one of the Committee was similarly affected. They did not want to screen themselves; but the thing was done in a funny way. He remembered he said to a certain gentleman: "What shall we do about these plans?" and he replied: "Don't say anything about these plans just now. When I want to know anything about them, I will ask the question." He (Mr. Tatham) said: "You hear that, Mr. Humphrys?" They left it in the hands of the then Town Clerk to go through the inquiry, never dreaming for a moment that there would be anything said about it afterwards. The Committee thought that everything would go in proper order—that the matter would go before the Local Government Board in due course, and that everything would be right. But for the unfortunate accident at the works, they would not have heard anything about the matter. He felt very much for Mr. Humphrys; and if he could go in his place, he would do so. When the inquiry was held by the Local Government Board Inspector, both sets of plans were on the table. The Town Clerk observed: "The plans are on the table, Mr. Inspector;" and the Inspector replied: "All right, I have got my own plans." Mr. Humphrys had to bear the blame now because he was an official of the Corporation; but every member of the Committee was as responsible for what was going on as Mr. Humphrys.

Mr. Cripwell declared that with regard to the change of plans the matter was one which was left entirely with the late Town Clerk.

The amendment moved by Councillor Smith to the Gas Committees' report was defeated by an overwhelming majority—only the mover and seconder voting in its favour.

NOTTINGHAM CORPORATION GAS UNDERTAKING.

The Question of Meter-Rents—Prospective Changes in the Works.

[From Our Local Correspondent.]

Renewed attack has been made at Nottingham upon the system under which the Corporation charge gas-meter rents. The matter has been more than once debated; but the claim put forward ostensibly on behalf of the smaller consumers has never met with a smaller measure of practical support than in the course of the debate at last week's meeting of the Council—the general ground of objection, apart from consideration of the merits of the contention involved, being that the present is a particularly inopportune time at which to embark on a change, having regard to the higher price of coal and the large capital expenditure now in contemplation for the purpose of bringing the gas-works up to the latest standard of efficiency. Incidentally the consideration was emphasized that, of the various large corporations, Nottingham and Bradford are the only ones now remaining which impose meter-rents. Mr. Bowles, one of the rapidly dwindling band of Socialist representatives who now occupy seats upon the Nottingham Council, brought forward the proposal; arguing, in view of the fact that a profit of £1,019,000 had been made upon the gas undertaking in the course of the last ten years, that the Council could well afford to abolish the charges, which only represented what he described as the "paltry" sum of £6700 a year—an observation which drew from Sir John Turney an expression of the wish that he had as his own annually that which was deemed so insignificant an amount, and that people who talked so glibly about such sums were either very rich or did not know what these amounts meant. Mr. Bowles was pertinacious, however, in his advocacy of the justice of the concession; pointing out that, within the decade mentioned, out of the large profit made, £400,000 had been contributed in aid of the rates, "after paying big sums into all sorts of funds," and allowing for expenditure in connection with the Radford works, where, it may be recalled, a new Glover-West plant of vertical retorts is now in course of installation. His main grievance appeared to centre in his allegation that the money secured from the profits, and applied in rate-relief, had mainly gone into the pockets of a small handful of landlords, whereas it had been derived solely from the users of gas and returned in some instances to people who never contributed a farthing to the gas revenue. Moreover, he said practically 50 per cent. of English towns did not now know what gas-meter rents were. Mr. E. Gutteridge (Mr. Bowles's only remaining Socialistic colleague in the Council) naturally seconded the resolution.

A business view of the consideration was presented by Mr. E. Harlow

who, when the Liberal party was in the majority upon the Council, occupied the position of Chairman of the Gas Committee, at a period which proved one of an especially stormy character in relation to the control of the undertaking. He directed attention to the fact that the Committee was now face to face with many problems of vital importance as to the making of gas. And here it may be incidentally mentioned that, in addition to the installation of vertical retorts at the Radford works, some further schemes of possible far-reaching importance are now in the air. Nothing has yet come before the Council in the form of a report; but the result of an extensive Continental tour recently undertaken by Mr. Alderman Albert Ball, the Chairman of the Committee, in conjunction with Mr. John Wilkinson, the Engineer and Manager, is being awaited with considerable interest. The object was to investigate the value of some of the latest and newest appliances in use; and although details are not at present available, it is understood to be not improbable that, in addition to works already in hand locally, something in the nature of definite recommendations will before long be forthcoming as to new coke-ovens, of which the German centres included within the recent itinerary afforded significant examples. Mr. Harlow pertinently called attention to the fact that the vertical retorts now under construction are destined to effect a very striking difference in working arrangements, and when the financial results attendant upon the new carbonizing process are known, it would, he thought, be the time to consider the change as to the meter-rents. There was also, he remarked, a very considerable advance in the price of coal to be borne in mind; and, on all grounds, therefore, he urged that it would be unwise, until they knew what profits had been made, to pass on to the Gas Committee such an instruction as was contained in Mr. Bowles's resolution, which was: "That, before allocating any of the profits from the Gas Department for the year 1912-13 for the relief of the rates, provision be made for the abolition of all gas-meter rents from April 1 next."

Among the speakers in opposition to the resolution was Alderman Radford, who was for many years a member of the Gas Committee. While admitting there was a great deal to be said in favour of the resolution, he regretted his inability to accord it support. Matters had, he said, been precipitated owing to the action of the Finance Committee in taking £39,000 from the gas profits in aid of the rates. Urban authorities in the county, who depended for their supply upon the Nottingham Corporation, were calling attention to the matter, and the problem would have to be faced. In other of the large towns, meter-rents were becoming obsolete. At the same time, he agreed that it would be unwise to force the hands of the Gas Committee at this juncture; and he moved, as an amendment, that the Committee should be asked to take the matter into their consideration, and report to the Council in the near future.

Alderman Ball declared that the demand for the abolition of meter-rents could not have come at a more inopportune time. It was not a good business proposition, as it would be equivalent to reducing the price of gas 1d. per 1000 cubic feet. The Department had 40,000 prepayment meters in use, costing £80,000, for which no rent was paid, and for which last year a reduction of 1d. in the shilling was made.

In replying on the debate, Mr. Bowles challenged Alderman Ball to accept a referendum of consumers upon the matter; but the appeal passed unheeded. The Council would not listen to either the resolution or to the amendment; both being rejected—the latter by 27 votes to 19, and the former by 28 votes to 4. Whatever the ultimate decision of the Council upon the question may be, there appears to be a growing feeling locally that, if the meter-rents are not entirely abolished, equitable considerations call for some substantial reduction of the prices at present charged; and therein may be found a partial solution of the difficulty. Although only a fringe of the main question of the undue milking of gas profits in alleviation of local rates was touched, the discussion may yet serve a practical purpose.

MANCHESTER AND STOCKPORT EXTENSION SCHEME.

The Proposed Inclusion of Heaton Norris.

A report appeared in the "JOURNAL" for Jan. 14 (p. 124) of an inquiry held at Heaton Moor, by Mr. E. A. Sandford Fawcett, in regard to an application made to the Local Government Board by the Corporations of Manchester and Stockport for an extension of their boundaries so as to include Heaton Norris. The Urban District Council supported the Manchester Corporation; but some of the ratepayers were wishful to secure the continued separate existence of Heaton Norris. Evidence was given that Manchester supplied water to Heaton Norris; while for Stockport it was stated that this district at present formed the most valuable portion of their gas and water area, and that the association of Heaton Norris with Stockport was incomparably closer than any it had with Manchester. Mr. J. G. Newbigging, the Manchester Corporation Gas Engineer, said analysis had proved that the Manchester gas was better than that supplied by Stockport, and it was appreciably cheaper; but Mr. S. Meunier, the Stockport Gas Engineer, and Mr. W. R. Herring pointed out that the severance of Heaton Norris from Stockport would be a great blow to the Corporation gas undertaking.

The report of the Inspector has now been received; and in it he recommends that practically the whole of the districts should be added to Stockport—only a very small portion going to Manchester.

Brynmawr and Blaina Gas Company.—The accounts presented at the recent annual general meeting of this Company showed that the revenue last year amounted to £8396, and the expenditure to £7377; leaving £1019 to be carried to the profit and loss account. Of the revenue, £2636 came from ordinary consumers, £2825 from those using prepayment meters, and £1416 from sales of residual products. There was a credit balance of £1155; and the Directors recommended dividends of 5 per cent. on the preference and ordinary stock, free of income-tax. This was agreed to,

GAS WORKERS' GRIEVANCES.

Strikes at Liverpool and Sydney.

A strike of the men employed at the Athol Street and Eccles Street stations of the Liverpool Gas Company occurred last Tuesday, and about a hundred men were affected. The reason assigned by the National Union of Gas Workers was that the management refused to reinstate a stoker, who they declared had been victimized because he was a prominent Trade Unionist. Last month he was reduced in rank; and this meant the loss to him of 9s. per week in wages. The matter was referred to the Council of the Transport Workers' Federation, to be discussed at their next meeting. In reply to inquiries by the Press, the Engineer of the Company (Mr. Edward Allen) repudiated the assertion that the dismissed stoker had been victimized. He further stated that the man was guilty of a serious breach of the Company's regulations, and consequently was removed from the retort-house to the yard. Subsequently some of his fellow-workmen had demanded his instant reinstatement; and on this being refused, they immediately left the works. Though the man could not be reinstated as a stoker, his position in the yard was open to him. On Thursday, about fifty of the strikers marched to the Linacre works of the Company with the view of trying to get the men there to come out in sympathy with those on strike; but the party met with no success, as the men expressed their perfect confidence in the Company. An attempt was made on Friday, by representatives of the Transport Workers' Federation, to end the strike; but it was unsuccessful, as Mr. Allen declined to discuss with the Union officials questions at issue between the Company and the men. It is stated that the men declare that the dispute is not in regard to one man, but has extended over eighteen months, and refers to rates of pay, number of hours' work, and conditions of labour. On Saturday the strike extended to the Garston works, when nearly 50 men on the morning shift refused to start work.

As recorded in the "JOURNAL" last week (p. 620), a strike of gas workers occurred in Sydney (N.S.W.) on the 28th ult., and caused considerable inconvenience owing to the resulting short supply of gas. The Minister of Labour and Industry (Mr. Carmichael) intervened with proposals for a settlement; but they were rejected. The Lord Mayor of Sydney thereupon convened a public meeting, and appealed for volunteers to assist the Companies in maintaining a supply of gas; and the Government decided to guarantee protection to free labour. There was considerable disorder at the meeting above referred to; and a free fight occurred, in which the police had to use their truncheons. On order being restored, many of those present entered their names as volunteer stokers. After the meeting, the Lord Mayor and a number of volunteers, including University undergraduates, proceeded to the gas-works, and attended to thirty furnaces; his Lordship doing a four-hour shift. On Wednesday, the North Shore Gas Company were able to furnish an intermittent supply. A conference between representatives of the Companies and the men subsequently took place, and happily with satisfactory results. On Friday, the strike was declared at an end; and it was stated that the men would return to work next day. A Reuter telegram from Sydney on Saturday said: "The gas-workers resumed work at two o'clock to-day. The terms of the agreement included provisions for an immediate resumption and no victimization. The Government has promised to call a special session of Parliament within twelve days, to amend the Arbitration Act and to enable the Wages Board to deal with the dispute. Any increase in wages will be retrospective, and any resultant increase in the gas-rate will be made operative for a sufficient period to enable the Companies to recover the expenditure due to the retrospective effect of the award. The gas supply is already restored."

INCREASED GAS STORAGE NEEDED AT BURNLEY.

Report by the Gas Engineer.

The Gas Engineer and Manager of the Burnley Corporation (Mr. J. P. Leather) has prepared the following report for the consideration of the Gas Committee.

I desire to draw the attention of the Committee to the need for the provision of considerably increased capacity for the storage of gas. It is the generally accepted rule that the gasholder capacity should be equal to the maximum consumption of gas in one day. On the 24th of December last, we sent out 3,909,000 cubic feet of gas. Our gasholder capacity has usually been given as 2,794,000 cubic feet. This includes 193,000 cubic feet for the "B" holder at the Lane Bridge works. This holder was in 1901 allocated for use as a relief holder for the carburetted water-gas plant, and is therefore not available for ordinary storage purposes. Deducting this, we have the available storage 2,600,000 cubic feet, which is only 66 per cent. of the maximum daily consumption.

In the year 1900, difficulty had already been experienced, and application was made to the Local Government Board for sanction to borrow £5000 for the enlargement of the holders at Stoneyholme by the provision of additional lifts. At that time there was also urgent need for increased manufacturing capacity, which was met by the installation of a carburetted water-gas plant. The ease with which this plant can be started and stopped as required, enabled us to carry on with a much smaller gasholder capacity than would otherwise have been possible. With care, no serious trouble has resulted until this winter, when the difficulty in obtaining oil has prevented the free use of the plant.

The length of time in summer during which a holder can be spared is not sufficient to enable us to empty the tanks of water, put in new rest-stones, new outlet-pipes, and also additional lifts with frame for supporting the crowns of the holder before the holder is again needed. The only practical method is to spread the work over two or three years as follows: This year we can empty the water out of No. 4 tank, put in new outlet-pipe and rest-stones, and prepare foundations for the

new frame for supporting the crowns. It is possible that this might be done before the end of July, in which case the water might be pumped quickly out of No. 3 tank into No. 4, and similar preparations be made in No. 3. Contracts could then be entered into for the additional lifts to be provided and erected the following year without the necessity of again emptying the tank. In this way the contractors for the enlargement of the holder could commence work much earlier in the year than they could if the tank had first to be emptied. If the contract was let during the present year, the ironwork would be prepared at the contractor's works during the winter months, and there would be ample time to erect it during the summer months.

The provision of the two additional lifts to each of the present three-lift holders will only add 936,000 cubic feet holding capacity. This will make the total storage available 3,536,000 cubic feet, which is still considerably less than the maximum daily output during the past winter. I therefore recommend the Committee to seek without delay a new site on which a holder of a capacity suitable to the undertaking could be put up. Large holders not only cost less per 1000 cubic feet to erect, but require less attention in working than smaller ones; and we ought to have one of 2,500,000 to 3,000,000 cubic feet capacity. Much larger holders would have been erected in 1880, but the land at Stoneyholme would not allow of it; and a project for a new site at that time was negatived on account of the question of the greater cost. With the increased cost of materials and labour, the borrowing powers obtained in 1900 will probably not suffice for the work at Stoneyholme. The estimate of £5000 was made at a time when iron was much cheaper. The cost of providing a holder on a new site cannot be estimated until the site is known, as an important item will be the mains connecting the new holder to our present works. The details of the holder itself will also depend somewhat on the site chosen.

The selection of a new site should be made with reference to future extensions of manufacturing plant. Not less than 10 acres of land should be secured. Before such land can be used for either gas manufacture or storage, a Provisional Order will have to be obtained. As the necessary notices in connection with a Provisional Order occupy much time, it is desirable that the preliminary consideration be at once proceeded with, so that the site can be fixed upon at an early date.

KIRKCALDY GAS-WORKS EXTENSION.

A lengthy statement by Mr. James Kincaid, the Manager of the Kirkcaldy Gas-Works, was submitted at a meeting of the Gas Committee last Tuesday by Bailie Wright, the Convener, at whose request the particulars had been compiled. The statement showed the probable cost of gas per 1000 cubic feet to the consumers, assuming (1) that the scheme of reconstruction on the present site as recommended by the Gas Committee at a previous meeting be carried out, and (2) that new gas-works be erected on a fresh site to take the place of the present one.

It was indicated at the outset that, owing to the continued rise in the price of coal, it might be necessary under any circumstances to increase the price of gas for the year 1913-14. For that financial year it was calculated that the cost of coal, less the better prices obtained for residuals, might amount to at least £1000 over the present year. Without taking into account the probable credit balance of £1200 at the end of this year, the price should be raised from 3s. 2d. to 3s. 4d. or 3s. 5d. per 1000 cubic feet. Mr. Kincaid then proceeded to calculate the effect of the two schemes on the assumption that the scheme of reconstruction, and the new works scheme, would take until the end of 1916-17 to complete, and that the cost of coal and other material would remain fixed, and the general conditions continue as during the year 1913-14. The figures were prepared, not to show what the price of gas would be, but to indicate the difference in price under the two schemes. The price of gas would vary according to the price of coal and bye-products, but the difference would continue the same under any conditions.

The capital borrowed at present is about £145,000, as, in addition to the cost of the undertaking, a sufficient amount of working capital must be available. Under the reconstruction scheme, the cost is estimated at £46,800, with £2400 added for ordinary expenditure, making a total of £49,200 spread over the four years, as would probably be required. In the new works scheme, the probable cost is estimated at £76,500, with £2400 added for ordinary capital expenditure, making a total of £78,900 expended over four years. Included in the probable outlay for new works was a sum of £4500 for land. The manufacturing and gas-holder capacities of the extensions allowed for were practically the same under both schemes. The following were the figures given; and for comparison, the cost of gas with no improvement carried out on the present works, and consequently no further savings, is placed alongside:—

Year.	Existing Works.	Reconstructed Works.	New Works.	Difference in Favour of Reconstructed Compared with New Works.
	s. d.	s. d.	s. d.	d.
1913-14 . .	3 4·70	3 4·70	3 4·70	..
1914-15 . .	3 4·70	3 4·48	3 6·00	1·52
1915-16 . .	3 4·70	3 4·48	3 8·12	3·64
1916-17 . .	3 4·70	3 1·65	3 11·86	10·21
1917-18 . .	3 4·70	3 1·37	3 3·12	1·75
or				
*1917-18 . .	3 4·70	3 0·00	3 3·12	3·12

* With railway to reconstructed works.

It will be seen that, with the reconstructed scheme, as compared with the existing arrangement, a reduction of 4¾d. per 1000 cubic feet would be effected were railway facilities obtained in 1917-18. This is brought about by improved results equalling 8d., and cartage 1¼d., less 4½d. for interest (reduced through the operation of the sinking fund), and sinking fund. Mr. Herring estimated the savings at 2d. per 1000 cubic feet more than Mr. Kincaid. If, therefore, his figures prove to be correct, the difference would be 6¾d.

Comparing the reconstruction scheme with the new works scheme, the increasing difference up to 10¼d. in 1916-17 is brought about, not so much by the increased interest and amount set aside to sinking fund, as by the fact that no saving can be effected by the new works until after the works are completed; whereas with the reconstruction scheme, economies are effected at once, and these more than meet the increased capital charges as the scheme develops. The difference in price of 3d. in 1917-18 between the two schemes would gradually disappear through the working of the sinking fund; but a much more serious feature was pointed out. With new works, the enormous increase in the price of gas up till 1917-18 would cause large power and lighting consumers to discontinue its use to a considerable extent, by seeking cheaper methods. In this event, the burden would fall heavily on the small consumers.

The plans which have been approved of by Mr. Herring show that, on the ground already belonging to the Town Council, three times the quantity of gas at present manufactured can be produced. It has been demonstrated that, under existing conditions, the manufacturing charges per 1000 cubic feet are from 8d. to 10d. more than need be. The price at which gas would require to be charged were a new works erected, places that scheme beyond consideration. Therefore the course recommended by the Gas Committee is the only acceptable one under the prevailing conditions. The present proposal is to increase the purifying power at the works and to augment the coke-storing area, which now only equals ten days' production. This extension is part of the reconstruction scheme, but, being considered alone, will bring about an annual saving of £300.

It should, the statement adds, be borne in mind that, if it becomes necessary to increase the price of gas, such increase will be brought about solely by the enhanced cost of coal. The increase per ton since May, 1910, when the Town Council took over the gas undertaking, amounts to about 3s. The methods whereby the undertaking can become successful, and gas be sold at a low price to the consumers, are by an increased output and reduced cost of production. The extension now recommended aims at both.

Sentence on a Former Gas Company's Solicitor.

At the Central Criminal Court last Thursday, before Mr. Justice Banks, Robert Henry Rushworth pleaded guilty to a charge of purjury. The circumstances of the case have been reported in previous issues of the "JOURNAL;" but they were set forth by Mr. R. D. Muir, who appeared for the prosecution. He said that in June last Rushforth, as Liquidator of the Amersham Gas Company, had in hand £256 18s. 2d., of which £215 was due to contributors. He failed to obey an order to pay the money into the Bank of England; and when it was proposed to issue a writ of attachment against him, he swore affidavits in which he asserted that the cash had been paid over. Mr. Wild, K.C., for the defence, said the prisoner had practised as a solicitor at Amersham since 1894. He was Clerk to the Guardians, Superintendent Registrar, and Clerk to the Justices, the Tax Commissioners, and the Parish Council. He fell into difficulties owing to the failure of clients to pay money which they owed him, and swore the affidavits on Amersham Railway Station to avoid being committed for failure to obey the order of the Court. The tragedy of the position was that he received £305 immediately afterwards, and the next day posted cheques to the people whose names he had used in fabricating the receipts. His Lordship said it was quite impossible for him to sit there and allow it to be thought for a moment that a man in prisoner's position could swear a false oath, knowing it to be false, to save his own skin. He passed sentence of twelve months' imprisonment in the second division.

Gaslight and Coke Company's Territorials.

In the Rifle Range Buildings at the Beckton Gas-Works, on the 1st inst., the sixth annual dinner took place of three important institutions connected with the works—the "G" Company, 12th battalion, County of London Regiment, popularly known as "The Rangers," the Rifle Club, and the Ambulance Brigade. The company numbered 255—Mr. J. N. Reeson, the Engineer-in-Charge at Beckton, being in the chair. Among those present was the President (Colonel Sir Corbet Woodall), Mr. D. Milne Watson, Mr. H. Rayner, and Mr. T. Goulden. After dinner, the prizes were presented by the President, to whom a vote of thanks was proposed by Captain A. A. N. Carpenter (of "The Rangers") who referred in doing so to the Company's generosity in allowing the men full pay while in camp. The vote was heartily accorded. Colonel Sir Corbet Woodall, having returned thanks, said one of the matters to which the Government might well give attention was the payment of Territorials when in camp. The Gaslight and Coke Company paid the wages because they were quite satisfied that the Company, as a Company, gained by the fact that the men went to camp and obtained their exercise. They were as salt among the bulk of the other men, and the Company got their money's worth. Not everybody could afford to do this. It was a hard struggle to the Company; but to many a trader it was almost an impossibility. It was a direction in which some sort of obligation to release employees in order that they might take this service should be arranged; and in this way they would be able to get universal service. Mr. J. H. Mills proposed "The Gaslight and Coke Company." He remarked that not only had the Company done their duty to the country as a commercial enterprise, but had taken their share in connection with the country's defence. The toast was acknowledged by Mr. Milne Watson.

At the monthly meeting of the Keighley Town Council held last Tuesday, it was stated that, owing to the largely increased cost of supplies to the gas-works, the Gas Committee could only hand over £3000 in relief of the rates this year.

AUSTRALIAN GASLIGHT COMPANY.

The Half-Yearly Meeting of the Company was held at the Royal Exchange, Sydney, on the 3rd of February—Mr. G. J. COHEN, the Chairman, presiding.

The SECRETARY (Mr. R. J. Lukey) having read the notice convening the meeting, the report of the Directors for the six months ending Dec. 31 was taken as read. This showed that the profits (after making provision for bad and doubtful debts, deducting interest on borrowed money, repairs and renewals, depreciation of plant, working expenses, and all other charges) amounted, with the balance brought forward, to £77,036. At a special general meeting held recently, it was resolved to increase the capital of the Company, by the issue of 70,883 £6 paid-up shares, to £1,274,994. The Directors therefore recommended the payment of a dividend for the half year on this amount at the rate of 10 per cent. per annum, which would absorb £63,749, and leave a balance of £13,287 to be carried forward. It was added that the Gas Act, 1912, having made provision for requirements in the direction of new capital and borrowing powers, it would not now be necessary to proceed further with the Company's Private Bill. With the exception of the price of gas, rate of dividend, and the clauses relating to the sliding-scale, capital, and borrowing powers, which were now in operation, the Gas Act, 1912, would come into force on July 1 next. The price of gas was reduced on Jan. 1 to 3s. 6d. and 4s. 4d. per 1000 cubic feet for ordinary and prepayment consumers respectively.

THE GAS ACT, 1912.

The CHAIRMAN, in moving the adoption of the report, said it afforded him much pleasure to meet the proprietors under so much happier circumstances than those of six months ago. Then, the Company was faced with contemplated legislation of so serious a nature that, if carried into effect, it would have involved the shareholders in a most disastrous loss. Happily, wiser counsel prevailed, and at the last moment, as the result of a conference between the two Houses of Legislature, a compromise was effected; so that what was now known as the "Gas Act, 1912," would, with the exception of four clauses applicable to this Company in particular, come into force on July 1 next. During the ensuing six months, the Company would be much occupied in carrying out their obligations under the Act, which would not entail any difficulties, as the most important regulations provided had been carried out for years past—in regard, for instance, to the illuminating power, pressure of gas, and meter testing. The clauses of the Gas Act now in operation were those relating to the price of gas, rate of dividend, and capital and borrowing powers. The latter had been so drawn that it would be unnecessary for the Company to again apply to Parliament when requiring more money for extensions. This important provision did away with the necessity of proceeding further with the Company's Private Bill.

REDUCTION IN THE PRICE OF GAS.

The price of gas was reduced on Jan. 1 to 3s. 6d. and 4s. 4d. per 1000 cubic feet for ordinary and prepayment consumers respectively. This would mean a reduction in the Company's revenue of over £40,000; and the only hope the Directors had of recovering this large sum was by increased consumption. He would like to say, however, that it was hardly necessary to obtain an Act of Parliament mainly to effect this purpose, as all the reductions in the past had, as far as he could gather, been purely voluntary on the Company's part, from the time when the rate was 25s. per 1000 cubic feet to the present price of 3s. 6d. So with regard to public lighting, irrespective of the rates named in the agreement, the price of the lights had been reduced from £10 to £3 15s.—the Company providing the pillars, which was contrary to the English procedure.

WORK TO BE CARRIED OUT.

The resumption of the Company's head station was officially gazetted on July 31 last, and the necessary legal documents were received from the Government a few days after this intimation. The valuation of the property was then entered upon, and an amount decided on, when the Government resolved upon taking the matter into Court for settlement, with the result that a new claim had been submitted by the Company, in consequence of increased cost of material, freights, and wages. Further developments were being awaited with interest. In the meantime, negotiations were in progress for an advance of £200,000, to meet the Company's immediate requirements for a new gasholder, retort-house, and the large trunk main necessary to bring the gas from Mortlake to Sydney, to maintain the city supply when the disconnection took place. The wharfage extensions in Darling Harbour of late years made it imperative that the Government should resume the works, which occupied about 6 acres. There were also other properties used in connection with the business, the whole of which had now been resumed. This would necessitate the removal of the head office to a more central position in the city. The capital of the Company had been increased to £1,274,994, on which amount a dividend of 10 per cent. was recommended, which would absorb £63,749, equalling the sum that would have been distributed on the former capital at the ordinary dividend. This arrangement was in conformity with the new Act, and was sanctioned by the proprietors at a special general meeting.

PROGRESS OF THE BUSINESS.

The progress of the Company had been well maintained, though not to the extent desired, owing to the Company having had to cease all extensions during nearly the whole of the past six months, and confine themselves exclusively to new consumers on the existing line of mains. As soon as the new Act permitted, steps were taken to overcome these arrears; and before very long all demands in this direction would, he anticipated, be met. Notwithstanding this temporary drawback to the Company's progress, he was pleased to say that the increased consumption of gas for the period under review was over 10 per cent.—the total quantity sold being 1,711,102,000 cubic feet. The number of consumers had increased 3000 during the half year, making the total now on the books of 107,863. The public lamps numbered 88 more than in the corresponding period of the previous year—there being now in use 10,606. These would undoubtedly decrease in future, as from Jan. 1 several of the suburban municipalities adopted the electric light for public illumination. So far, however, as he could gather, the change had not given anything like the satisfaction that was confidently expected by the councils interested. The day consumption equalled that of the night—due doubtless to the increasing use of gas for power and cooking and other domestic purposes. So far as gas-cookers were concerned, the Company had supplied to date over 29,000; and the manufacturers of other patterns than the "Eureka" stove had also increased their sales, while gas appliances of various kinds were extensively used. The progress of the Company was further illustrated in the continued demand for mains and services. In the past half year, 48 miles had been laid to meet the extensions now proceeding, particularly in the suburbs; making the total mileage 2749. In meeting the growth of the Company's business, the expenditure naturally increased. Wages alone now exceeded £5000 per week. The Directors naturally thought that, having so recently met the workmen's demands, they would have loyally stood by their three years' agreement made in September, 1911, instead of which an agitation had been going on for some time for a variation of the award, to allow of increased pay. This would have to be settled by the Arbitration Court—that being the only tribunal recognized under the Gas Act. He could not close his remarks without reference to the staff, whose anxiety for the Company's welfare was always manifested. The officers had experienced a most trying time during the past few months; and to the strenuous exertions of the Secretary (Mr. R. J. Lukey) in particular, were due, in no small degree, the satisfactory results to the Company obtained in the measure under which gas companies would have to work in future.

The resolution was seconded by Mr. W. C. GODDARD, and carried unanimously.

On the motion of the Hon. R. J. BLACK, M.L.C., seconded by Mr. D. ROXBURGH, the remuneration of the Directors was increased from £1500 to £2500 per annum, and the Auditors' fees from £50 to £100 each per annum. This has, however, to be confirmed at another special meeting of the proprietors.

A unanimous vote of thanks having been passed to the Directors and officers for their efficient management of the Company's business during the past six months, the meeting closed.

METROPOLITAN GAS COMPANY OF MELBOURNE.

The Half-Yearly Meeting of the Company was held at the Offices, Flinders Street, Melbourne, on the 28th of January—Mr. JOHN GRICE, the Chairman, presiding.

The report submitted stated that the net profits for the half year to Dec. 31, including a balance of £24,141 brought forward, amounted to £116,372. Of this sum there were transfers of £25,000 to the reserve fund, £5000 to the meter renewal fund, and £3000 to the gas-stoves, &c., account. A dividend of 6s. per share was recommended, amounting to £51,432, and it was proposed to carry forward the balance of £31,940.

SUBSTANTIAL INCREASE IN BUSINESS.

The CHAIRMAN, in moving the adoption of the report and balance-sheet, said he was able to point to the fact that the substantial and steady increase in business experienced during the last two years had continued throughout the period under review. The sales of gas for the twelve months to Dec. 31 were 2321 million cubic feet, against 2101 million cubic feet for the year 1911, showing additional sales of 220 million feet, equivalent to an increase of 10½ per cent. The number of ordinary meters, at 100,444, showed an increase of 8025; and that of prepayment meters, at 22,831, an increase of 2369. The number of stoves on hire at Dec. 31 last was 10,773, as compared with 10,206 at the end of 1911, a gain of 567; and they sold for cash, or on the hire-purchase system, during the twelve months, no fewer than 12,371 stoves—a sale of (say) 40 for each working day in the year. The actual number of stoves in use, irrespective of sales outside of their department, was, at the close of the year, 12,909 in excess of the number in use at Dec. 31, 1911. The aggregate number of stoves now fixed by the Company in consumers' premises was 30,125 greater than it was at the end of 1909—three years ago. It was worthy of record, also, that a large number of these additional stoves were being installed in the homes of the slot-meter consumers. Again making a comparison with the year 1909, when one out of every four of their consumers was cooking by means of gas-stoves, they were now able to say that two out of every three slot-meter consumers were using stoves, and such a rapid increase led them to think it probable that it was only a matter of time for this convenience to be fixed in every house. Turning to the balance-sheet, it would be seen that the returns from sales of gas totalled £272,243; and this figure compared with £265,985 for the December half of 1911, and represented an increase of £6259. The quantity of gas sold in the half year was nearly 10½ per cent. over the December half of 1911; and the comparatively small increase in cash was due to the lower price of 4s. 7d. per 1000 cubic feet (against 5s. last year) charged for gas, which had been in operation during the whole of the period under review. At the meeting in June last, it was mentioned that £45,000 was the estimated shortage of revenue from this cause for the full twelve months. The actual loss during the past six months had amounted to £22,017. The residuals sold accounted for an increase in revenue of £6052 over the corresponding half of 1911. The balance carried down from revenue to net revenue account was £111,600, as against £123,294 for December, 1911, a reduction of £11,694, consequent upon the lowering of the price of gas. Had the reduction not been made, the balance to be carried to the net revenue account would have been £10,323 in excess of the corresponding figure for December, 1911. In disposing of the profits for the half year, the Board followed their usual practice of appropriating £25,000 to the reserve fund account, and to providing for depreciation of meters and stoves; but they had not found it necessary to make further provision from net revenue account for works reconstruction account, as the past four half years. With the output still increasing

there was a substantial amount of work of the same character as that already carried out still ahead of them, in the way of demolition of old works and plant, to allow of the erection of new buildings and the laying down of new plant as required; and for such special repairs, including new retorts, a provision of £10,000 had been included in the present balance-sheet, under the head of repairs at works. The Directors recommended a dividend of 6s. per share for the half year; and, having regard to the low rate of interest, nominally 10 per cent., but really only 6¾ per cent., which the shareholders for many years had been receiving on the so-called paid-up capital, which included premium capital £466,535, the Board, in view of the concession of £45,000 per annum given to the consumers, were of opinion that the time had arrived when the dividend should be increased. The 6s. per share now proposed only gave the moderate return of 7¾ per cent. on the total capital found by shareholders.

THE NEW VERTICAL RETORT INSTALLATION.

At the last half-yearly meeting, he reported that the new vertical retort installation at the South Melbourne works was that day being put into operation for the first time. They had now had six months' experience of this latest method of carbonization; and the results obtained from the five beds of retorts had been of a satisfactory character. It must, however, be borne in mind that the quantity of gas manufactured by this particular portion of the Company's plant represented a very small proportion of the total daily output of the three works; and the saving effected was consequently at present hardly appreciable. Unfortunately, the larger installation of fifteen beds of similar vertical retorts at West Melbourne, which they had hoped to have working some time ago, had not yet been put in action. When these were in operation, the proportion of gas manufactured by their vertical retorts would be approaching one half of the total output. It might be well, however, in order to prevent any misunderstanding in the future, that he should point out that such economy of working as might arise from the manufacture of a certain portion of the output of gas by means of this new system of working, while proving ample justification for its adoption, would not counterbalance to any large extent the increased rate of wages and the extra freight that would have to be paid under the new coal contract. Last January the shareholders were informed that the Directors had approached Parliament with a view to obtaining a Bill for the purpose of authorizing the exchange between the City Council of Melbourne and the Company of certain areas of land at West Melbourne, necessary to the completion of the scheme of reconstruction at the works. The Bill was passed towards the end of last session; and steps were being taken to effect the exchange referred to.

THE GAS INQUIRY BOARD.

Referring to the report of the Gas Inquiry Board, the Chairman said: Your Directors have given, and are still giving, the most careful attention to this matter, and say that, notwithstanding the findings of the Board of Inquiry, the Company has respected and carried out to the letter the many and onerous responsibilities cast upon it by its Act of Incorporation. They also intend to protect to the utmost of their ability the rights which the Victorian Parliament, by its statutory contract, gave to the shareholders' and debenture holders' capital invested in the undertaking. The Inquiry Board found that the Company had, in certain years, carried to reserve fund amounts in excess of the limit prescribed by its Act of Incorporation; but they added to that finding this qualifying sentence: "But such amounts in excess did not affect the price of gas, as determined by the sliding-scale." They also found that the Company may not set aside out of profits sums in lieu of depreciation, or for any other purpose (except for depreciation of works on leasehold lands), in excess of the limits proposed by section 133 of our Act. The amounts said to be in excess were (except as to very small items in the balance-sheets of 23 and 24 years ago) for special provisions for reconstruction, for depreciation, meter renewals, and cost of coal strike. They were amounts quite separate in the account from the reserve fund, and were not carried to it. They were profits which might have been paid to shareholders in dividends, had not the Directors, with your consent, withheld them to utilize in the best interests of the public and the undertaking. As to the provisions for reconstruction, the Inquiry Board in its report said: "The expenditure on the work was undoubtedly necessary; but the method followed in making the provision was not in accordance with the scheme of accounts and the provisions of section 133, and did not show to prospective purchasers the Company's true net profits." And again: "If the Company had followed the form of accounts of the Act, this [the expenditure on reconstruction] would have been met in the ordinary course by the undivided profits carried down from previous years." In other words, the Inquiry Board is of opinion that shareholders' undivided profits, instead of being transferred to separate accounts for book-keeping purposes, should have been left for subsequent expenditure in the balance of net profits carried forward from year to year. Of course, one could comment freely on such findings; but perhaps this is not the time or place to do more than point out that, if the Directors did not set aside for the depreciation in stoves, fittings, and meters (which continuously goes on from the time they come into stock), they would, in their opinion, be presenting a misleading, if not a dishonest, balance-sheet; and the impropriety, whatever the form of accounts, of carrying on a manufacturing company without writing-down for depreciation on such articles, is palpable to any business man. A decision that these very modest sums for depreciation (far less than are allowed to gas companies by the Income-Tax Commissioners in Great Britain) can be called additions to the reserve fund, section 133, is hard to understand. As to the four sums of £20,000 each transferred to reconstruction account being also considered as additions to the reserve fund, my remarks of two years ago, when the first of these sums was set aside, show clearly that this was not the Directors' intentions. The words I used were: "This £20,000 cannot be regarded in any sense as a supplementary reserve fund; it is of a character quite distinct from the purpose for which that fund is created." The most dangerous and inequitable recommendation of the Inquiry Board is to the effect that "the standard price of gas be subject to periodical revision." In whose hands this power is proposed to be invested, and upon what grounds, or at what intervals, it is intended to be used, is not disclosed. But investors generally will ask themselves what man would put his savings into an undertaking producing for sale an article, the selling price of which would be subject to adverse control and interference by the Legislature. I need not point out to you that no company, much less a gas company, with its present risks and competition under such conditions, could go into the market for additional capital with any expectation of raising money on reasonable terms to conduct or extend its operations. We mention this to show to what extent the Inquiry Board is prepared to advise the Government to go, and how they have failed to grasp the security necessary for investors, but do not for a moment believe the Victorian Parliament is going to seriously damage its credit by repudiating one of its own Acts. Following within a few days the issue of the report referred to, it was stated in the Press that it was the intention of the Government to give consideration to the recommendations of the Board, with a view to the introduction of legislation dealing with the matters referred to in the Inquiry Board's report into the then sitting Parliament. Your Directors, on reading this statement, therefore addressed the Premier on the subject a letter of protest against such action, indicating, in our opinion, the only course which the Government can take to justify any proposed amendment in the Company's charter. [This letter asked that an appeal should be made to the Courts to determine the legality of the Company's actions on the charge brought against it, before Parliament is asked to repudiate its own enactment.] The only reply to this communication which has been received was an official acknowledgment in which a promise is made that "our recommendations would receive consideration." Our letter has remained without further reply; but an official announcement was made by the Premier to the Press on Nov. 11, that, notwithstanding the fact that it was doubtful whether Parliament could deal with many more subjects in the then session, the Cabinet had authorized him to consult with the parliamentary draftsman and the Crown law authorities for the preparation of a Bill to deal with some, if not all, of the points on which the recommendations of the Inquiry Board are made—at any rate, to deal with the more urgent matters. It would appear, therefore, that if consideration has been given, the Cabinet has decided to ignore our request, and to proceed to submit punitive legislation without legal proof that any breach of the existing law has been committed by the Company. It is only within the last few months that proposals in respect to the Australian Gaslight Company, of Sydney, were introduced by the New South Wales Government into the Legislative Assembly of that State. The drastic nature of the Government scheme, fortunately, had the result of awakening the minds of all classes of investors to the principle involved, and the threatened danger to the general interests of capital by the repudiation of an Act of Parliament without proper compensation. The members of the Legislative Council of New South Wales, supported by virtually the whole community who had anything to lose, and who saw what a stigma such an act would cast upon the credit of the State, so altered, or, as one of the papers said, reconstructed, the Bill, that the Act, as passed, was approved by the gas companies as fair to their shareholders. Our own opinion on the Inquiry Board's report might, of course, be considered as biassed—our individual interests being affected. So it would be well for you and others to hear the expression of an outside view of what was proposed in New South Wales and here. The extracts now quoted are from the first editorial of the "JOURNAL OF GAS LIGHTING" of Oct. 22 last. This is a long-established, high-class journal, published in London, and has a very wide circulation, not only in Great Britain, but through all the English-speaking communities. [The Chairman then read the article in question.] Surely these words convey a warning to those who would interfere with any investment made on the faith of an Act of Parliament. The Board of Inquiry, not being a Court of Law, has endeavoured to give a decision on purely legal questions, and in doing so has, in our opinion, gone astray in its views of the underlying principles of modern English gas legislation. I feel that you will not expect me to apologize for taking up your time in dealing with this matter, because it is one of the greatest importance, not only to the shareholders of this Company, but to every investor of capital in the Commonwealth; and it behoves all those who have an interest in seeing that the reputation of this community for fair dealing is maintained, by every means in their power to prevent that reputation being in any way destroyed.

The report and balance-sheet were adopted.

WANDSWORTH, WIMBLEDON, AND EPSOM DISTRICT GAS COMPANY.

The First Meeting of the New Company.

The First Ordinary Meeting of the new Company was an enthusiastic one. It was held at the Westminster Palace Hotel; and the large room was barely of sufficient capacity for the accommodation of the proprietors who attended. Mr. HENRY E. JONES presided.

The SECRETARY (Mr. Charles W. Braine) read the notice convening the meeting; and the Directors' report was taken as read.

RETIREMENTS.

The CHAIRMAN expressed the pleasure of himself and his colleagues at seeing such a large assembly of proprietors, and said it showed that the Directors had done a sensible thing in deciding to hold the meeting of the new Company in London. Proceeding, he said it would be seen that the Board had somewhat changed. They missed Mr. Blachford, who had been a member of the Mitcham Board; and a distinguished Director of the Wandsworth Gas Company, Field-Marshal Sir Evelyn Wood, who had rendered valuable services to the Company during the past two years. He should like to think that they all regretted the circumstances under which these gentlemen retired. But it was necessary, in order to meet the wishes of Parliament, that the Board should be reduced; and there were provisions under the new Act by which the Board would be further reduced in course of time. These were not the only retirements. Mr. Farnan, also the Secretary of the Epsom Gas Company, had retired. Mr. B. R. Green, the General Manager of

the Mitcham Company, had retired; and he (the Chairman) could not tell what a loss this was to the Company. However, Mr. Green had, under the Act of Parliament, the option of retiring; and he had exercised it. However, he was largely interested in the Company; so, if he kept his eye upon their affairs, they were bound to go straight.

THE NEW STANDARD OF QUALITY.

There was a difference between this meeting and an ordinary one. As a rule, the Chairman had to get the report passed before he could move the dividend. On this particular occasion, under the Act, the proprietors had had their dividends; so that they had the whip-hand of the Chairman. The Directors had mentioned in the report that the Act came into operation on Jan. 1. One feature in the Act was that a fresh standard of quality—calorific value—was substituted for illuminating power. This was a change that must be of great importance to the Company. The gas business had of late years been developed on new and broader lines—ever since the incandescent burner came in—and gas undertakings were now selling heat rather than light. It was high temperature that they wanted in an incandescent burner; and it was the heating power of the gas which was now tested. They had also been endeavouring, as far as possible, to encourage the use of the heating property of gas as fuel in a much wider field than there was for lighting. Therefore, even if gas undertakings had no monopoly of the field for lighting, it would be seen how important it was for their best friends, the consumers, to have exactly the heat they paid for.

A TRIBUTE.

At this stage, while speaking of the Act, he must pay to the Chairman and Board of the late Mitcham Company a great tribute for the co-operation, and the conciliatory and helpful spirit, they had evinced from the first part of the negotiations, during the passing of the Act through Parliament, and up to the present date. It had been a real pleasure to carry out, with their assistance, some of the works alluded to in the report—all those measures and works which would tend to unite and bond the distributing systems of the two Companies together, and which enabled them to realize what was going on to-day in the increasing sale of gas.

WORKING AND LOW CAPITAL.

In accordance with the Act, the proprietors had had notice that the new certificates would be exchanged for their old ones; and most of them had no doubt availed themselves of the opportunity of becoming possessed of the new scrip. They had also received their dividends, together with the accounts of the separate Companies. He need not go through the latter, but would content himself by saying that they were as good as ever. The working was excellent. There was just one blot upon the Wandsworth Company's accounts—that was the price they had paid for coals. To a certain extent, there was also a reduced output of gas per ton of coal, inasmuch as less enrichment was used for this purpose. Allowing for this less enrichment, the working had been as good as it ever was. How it had been so, he hardly knew; for, owing to the strike of coal miners last spring the erection of some new plant at their works at Wandsworth was so delayed, that in the middle of December—the time of the utmost stress upon works and management—the extensions were still uncompleted; and he really marvelled, as an old gas maker himself, how Mr. Carr managed to get through the winter so well as he did. With regard to the Mitcham accounts, they also showed most satisfactory working. He had had them analyzed side by side with those of the Wandsworth Company; and there was one feature that had been deliberately put into the report, because he wished the Mitcham Company to have its proper position in this alliance, and to show all interested how successful, prosperous, and well-managed had been the undertaking. The accounts of the Mitcham Company were absolutely first-rate. The return in gas and residuals per ton of coal carbonized was of the first order. Every economy had been practised. The specially interesting fact noted in the report was that, in spite of certain extensions at the Wandsworth works and in coupling up of mains, the capital expended per 1000 cubic feet of gas sold (which was already below that of the other Metropolitan Gas Companies, and almost the lowest in the kingdom) was for the Wandsworth Company only 6s. 7½d., and for the Mitcham Company 6s. 11½d. He wished this fact to appear on the published records, so that it might stand to the credit of his colleagues who administered the affairs of the Mitcham Company and of Mr. Green, their Manager. That Company were, indeed, at the time of the amalgamation, rapidly coming into a position financially in this respect equally as strong as the Wandsworth Company had been in for many years past, and which was one of the secrets of the low price of gas in the Wandsworth area. Indeed, as seen, there was, at the time of the amalgamation, very little difference between the two Companies in this matter of the capital per 1000 cubic feet.

THE FIRST FRUITS OF AMALGAMATION.

The report also mentioned that—carrying out the promise made at the time the proprietors were asked to approve the Act of Parliament which united the Companies together—a reduction in the price of gas had been made (and this was notified some months before the end of the half year) of 3d. per 1000 cubic feet in the Mitcham and Wimbledon district, and of 4½d. in the Epsom district. Remember that this meant another thing. It meant that the Mitcham proprietors would be entitled to receive ⅜ per cent. more dividend, and the Epsom shareholders ½ per cent. more; so it would be seen that the benefits of this act of amalgamation which the Directors urged upon the proprietors for their consideration had already manifested themselves. It was rather curious that, in the negotiations between the two Companies, anxiety was shown for some provision to be made as to the rate to which the price of gas should be reduced—of course, without coming down to the price of 1s. 9d. at which gas was being sold in the Wandsworth area. When they came to discuss the Act of Parliament (which they did very happily) with their friends the public authorities of the district, it was a matter of great surprise that they approved a scale which was very little different from what the Directors had already arrived at as a righteous and proper scale. When gas was at 1s. 9d. per 1000 cubic feet, the price could not be pulled down by 3d. or 4d. But with the price in the Mitcham and Wimbledon district at 2s. 8d., there was room to take something off; and the same in the Epsom district. This was a satisfactory result of the negotiations, because it removed from their path many obstacles in dealing with the Bill when before Parliament.

CONSUMPTION AND POTENTIALITY.

He had alluded to the spirit which the Mitcham Directors showed while yet unallied with the Wandsworth Company. Last August it suggested itself to the Wandsworth Board, and he (the Chairman) was the mediator, to make overtures to them regarding the propriety of preparing for the winter, and to put, so to speak, their pipes in order. They did this, with the small effect upon the capital of which he had spoken. The event proved the wisdom of their action. When they came into the December quarter, there was a very large and heavy increase in both Companies. In the half year, the increase in the case of the Mitcham Company was as much as 12½ per cent., in the case of the Wandsworth Company 7½ per cent., and in the case of the Epsom Company 8½ per cent. He believed Mr. Green would confirm him when he said that they could not have met this increase in the half year had it not been for the facilities afforded by the intercommunication of the main pipes. This increase was going on still. Following the practice he had adopted in keeping an eye on these matters now that the Companies were amalgamated, he had daily reports sent to him. It might surprise the proprietors to hear that, on the previous Saturday, the increase in the sale of gas was 20 per cent.; and the increase for the week was something like 17 per cent. These were figures that extended over the whole district of the old Wandsworth and Mitcham Companies. There was a rapid extension going on in both these districts; and there were large opportunities there, through having area not yet filled up. He might claim credit for his colleagues and himself on the fact that, before the Companies got together, they saw there was this chance of an increase, and a continuing increase; and every precaution was taken in the way of proper provision for meeting the demand. The little Epsom Company, he ought to say, gave 20 square miles of area to the total territory; and the area of the Wandsworth Company was somewhere about 6 square miles, and of the Mitcham Company in the neighbourhood of 15½ square miles—the total area being 41½ square miles, of, in the main, very pretty and desirable residential country, and very busy area some of it was near the Thames. The Companies prior to amalgamation were all in the position of needing some small addition to capital expenditure. Now one thing that influenced him as a gas administrator who, like his old and new colleagues, was very careful about capital, was that they would all have had to put before the proprietors proposals for raising additional capital. It would be readily understood that this amalgamation was not going to pledge the proprietors to any prodigal expenditure. Rather the contrary. It would be less under the combined conditions than it would be separately. The report, however told them that the Board would bring before the proprietors on this occasion resolutions authorizing the raising of further capital.

MISCELLANEOUS MATTERS.

The report also informed them that the present Board were appointed under the Act; and presently a resolution would be proposed asking the proprietors to pay them for their services. The Board had also to ask for an increase in the salary of the Secretary, which he was sure would be thought necessary, as he was going to deal with both businesses. Auditors would also have to be appointed.

THE COAL STRIKE AND GAS COMPANIES AS MINE OWNERS.

Regarding general matters, there was the question of coals. The coal strike had one very curious reaction to their benefit. It, of course, did them a financial injury. In the Wandsworth Company, it cost at least £5000 the previous half year; and owing to the delay of the new machinery, also due to the strike, he calculated that their Manager had to resort to expedients that cost another £3000 in the past half year. This was one of the penalties they had to pay, though innocent of any part in the dispute. They had had a large advance in the price of coal upon what they had been paying for some years; and they hoped that the present price would not be exceeded under their new contracts. They had some long-headed gentlemen in the coal business who took good care of the law of supply and demand, which meant, in the case of gas undertakings, that they had to pay as much as these gentlemen thought fit to exact. The requirements of various gas companies were on a well-known scale; and colliery owners took good care that the companies paid heavy prices in meeting these requirements. The cure for prices jumping up and down in the awkward fashion that was now experienced was not the nationalization of the mines (which seemed to have been suggested in one direction), nor did he think it was to be found in stopping the export of coal. But he did think the gas companies ought to have got before now, or at any rate the large ones who had to use millions of tons of coal, into possession of some of the coal measures, although it might be said this was a strong order, and what would Parliament say? He was never afraid of Parliament when he had a straightforward story to tell it. If Parliament was told that the price of gas would probably fall, or at any rate be kept more regular, by gas companies being allowed to own their own coal mines, he could not see why Parliament should object. He could tell Parliament something else. By no possible system could the national wealth of coals be more economically developed than in the hands of the gas companies. The man who burned a ton of coal to make steam had no residuals. The man who generated electricity caused the coal he used under his boilers to disappear entirely. In almost every process, the coal disappeared in producing the result. Mark the difference in the case of gas making. For every ton of coal, some 11 cwt. of coke was brought back—coke which had a value little inferior to that of coal, and was fit for his drawing-room fire, as it was for the drawing-rooms of others. They also obtained about 1½ cwt. of breeze. They also obtained 1 cwt. of tar—valuable for benzol and other things, and for making roads dustless. They further obtained nearly 2 cwt. of ammoniacal liquor, which made one of the best fertilizers in the world. The balance was found in one of the best heating agents in the whole world—that of gas. This was why he was pleased to say they had a calorific value test instead of an illuminating power one. There was no waste on a gas-works. The only disappearance of any part of the full weight of the coal was in the small

percentage—not 10 per cent. nowadays—required for the heating of the furnaces. If this story were properly told to Parliamentary Committees, they would see that the best hands in the world in which to place coal, in order to secure the utmost from it, were those of the gas undertakings. The gas companies could help industry. With their gas they could drive the gas-engines, and with the same gas they could melt metals. In the Wandsworth district, some 48 million cubic feet of gas (as much as many small towns manufactured altogether) was used for the purpose of burning-off gas-mantles. In the East-end of London, gas was used for reducing metals at refineries like those of the Rothschilds and the Mint. In the East-end, too, gas was used for heating plates of ships, for pumping water supply, and for pumping the docks. There were thousands of industrial purposes to which one's grandfather never thought gas could be applied, but for which it was employed to-day, because of its heating power and adaptability. If the country wanted to economize the national resources in the way of coal, then the country should put it into the hands of the gas undertakings to deal with in the first place. He started on this matter intending to tell the proprietors of what issued from the coal strike. The Companies became inundated with orders for gas-stoves for cooking and heating, and he believed that a large portion of the increase in consumption that he had mentioned was derived from the fact that people had learned to rely more upon gas for domestic heating and for various trade purposes than before the strike. He then moved the adoption of the report.

The Deputy-Chairman (Mr. R. Garraway Rice), who was Chairman of the late Mitcham and Wimbledon Company, in seconding the motion, said there was only one point to which he would refer—that was, as to the reduction in the price of gas in the Mitcham and Wimbledon area. He certainly thought it would have been a venturesome policy for the Mitcham Company to have made a 3d. reduction if they had had to build the large duplicate works which they had begun, before amalgamation was mooted, to plot and to plan out. The reduction of 3d. was entirely due to amalgamation.

Mr. J. Plumridge inquired whether the Board had any idea of asking for a Stock Exchange quotation.

The Chairman replied that a broker had been engaged for this purpose.

The motion was unanimously carried.

Directors' and the Secretary's Remuneration.

The Chairman, in introducing this matter, said the object of amalgamation was to effect economies. He found that the total fees of the three Boards previously in existence was £4800. In the case of the Wandsworth Company, the fees amounted to an average of about £417 apiece, but the Directors gave the Chairman a little extra. The proposition he had to commend to the proprietors was that they should enable the Directors to put their new colleague on the same footing as the old Wandsworth Directors, with power to them to give out of the sum voted something extra to the Chairman. He noticed that the proprietors of the South Suburban Company had agreed to pay their Board (with two-thirds the number of Directors) £3600 a year.

Alderman Porter seconded the motion. He remarked that the report they had passed was a satisfactory one, and the undertaking was going on well. The Company had plenty of scope; and there was an abundance of work before the Board.

The motion was agreed to.

The vote having been duly acknowledged,

On the proposition of the Chairman, seconded by the Deputy-Chairman, an addition of £100 a year, free of income-tax, was also made to the Secretary's salary.

The New Auditors.

Moved by Mr. G. J. Dale, and seconded by Mr. Bosher, Messrs. E. L. Burton and H. Willis Smith were elected Auditors.

Both Messrs. Burton and Smith acknowledged the confidence of the proprietors.

Special Meeting.

New Capital and Debenture Stock Authorized.

A Special Meeting was then held, at which the Directors were authorized to raise, as required, the capital and debenture stock mentioned in the following series of resolutions, which were separately moved by the Chairman, seconded by the Deputy-Chairman, and passed:

(1) That the Directors be, and are hereby, authorized to raise from time to time the sum of One Hundred and Fifty Thousand Pounds (£150,000) part of the "Unallocated Capital" authorized by the Wandsworth, Wimbledon, and Epsom District Gas Act, 1912, by the creation and issue of Ordinary Stock not exceeding in amount, with premium (if any), the before-mentioned sum, in accordance with the provisions of the said Act, and under such terms and conditions as they may think fit, and that such stock, and any further new stock that may be created and issued under this Act, be designated and known as "New Ordinary Stock."

(2) That the Directors be, and are hereby, authorized to create and issue from time to time in respect of the borrowing powers of the Company which at the passing of the Act were exercised by the issue of Debenture Bonds in the Mitcham and Wimbledon District Gas-light Company amounting to Sixty Thousand Pounds (£60,000) so far as such bonds have, or shall be hereafter paid off, such additional Debenture Stock as is in accordance with the provisions of the Wandsworth, Wimbledon, and Epsom District Gas Act, 1912, and under such terms and conditions as they may think fit, and that such Debenture Stock bear interest at the rate of Four (4) Per Cent. Per Annum, to be paid half-yearly on the 1st January and the 1st July in each year, the first payment of interest on such Stock as shall have been issued to be made when and as the Directors think fit.

(3) That the Directors be, and are hereby, authorized to create and issue from time to time additional Debenture Stock in respect of "Allocated Paid-Up Capital" as is in accordance with the provisions of the Wandsworth, Wimbledon, and Epsom District Gas Act, 1912, to an amount not exceeding, with premium (if any), Twenty-Six Thousand Eight Hundred and Twenty-Two Pounds, Nine Shillings, and Fivepence (£26,822 9s. 5d.), under such terms and conditions as they may think fit, and that such Debenture Stock bear interest at the rate of Four (4) Per Cent. Per Annum, to be paid half-yearly on the 1st January and the 1st July in each year, the first payment of interest on such Stock as shall have been issued to be made when and as the Directors think fit, and that the said Debenture Stock be designated and known as "4 Per Cent. Debenture Stock."

(4) That the Directors be, and are hereby, authorized to create and issue from time to time in respect of the "Unallocated Capital" such additional Debenture Stock as is in accordance with the provisions of the Wandsworth, Wimbledon, and Epsom District Gas Act, 1912, and under such terms and conditions as they may think fit, and that such Debenture Stock bear interest at the rate of Four (4) Per Cent. Per Annum, to be paid half-yearly on the 1st January and the 1st July in each year, the first payment of interest on such Stock as shall have been issued to be made when and as the Directors think fit.

Mr. H. D. Ellis pointed out that the existing Wandsworth and Putney debenture stock was 3 per cent.; and he asked whether it would not be an advantage to have all the debenture stock of one denomination, so that it could be quoted in one class.

The Chairman: All the new stock will be 4 per cent.

Mr. Ellis pointed out that when the debenture stock of a company received a uniform rate of interest, it was worth more money than when part received (say) 3 per cent. and part 4 per cent.

The Chairman said that they took the advice of Mr. W. Richards; and he told them that the 3 per cent. was not marketable stock nowadays. He (the Chairman) did not think they could meet Mr. Ellis's views until they again went to Parliament, and obtained power to convert the 3 per cent. stock to 4 per cent. They would probably take that step when next in Parliament.

Votes of Thanks.

Mr. Walter Hunter moved, and Alderman Porter seconded, a hearty vote of thanks to the Chairman and Directors.

The Chairman having responded,

Mr. J. C. Potter proposed, and Mr. J. Plumridge seconded, a vote of thanks to the Engineer and Manager, Secretary, staff, and workmen of the Company.

The Chairman, in supporting the motion, stated that the co-partnership system had been running in connection with the Wandsworth Company for about two years; and the Directors of the Mitcham Company were so pleased with it, that they had before the amalgamation adopted it in principle, and had set aside out of the income of the past year a sum sufficient on the same scale for their own men. Nothing could be more important in connection with industry than co-partnership. As a disciple of the late Sir George Livesey, he knew of the benefit the system had been in the gas industry.

The motion was cordially agreed to.

The Secretary (Mr. Braine) and the Engineer (Mr. H. O. Carr) both replied on behalf of themselves, their respective staffs, and the workmen. Both, too, spoke of the strenuous work that the Chairman put into the whole of the affairs of the Company.

HARROW AND STANMORE GAS COMPANY.

Over 12 per Cent. Increase—Growth of the Undertaking.

The Ordinary Half-Yearly Meeting of the Company was held yesterday week, at the Holborn Restaurant, High Holborn, W.C.—Mr. A. H. Baynes, J.P., in the chair.

The Engineer and Secretary (Mr. J. L. Chapman) read the notice convening the meeting; and the Directors' report and the accounts were taken as read.

The Chairman, in moving their adoption, first commented on the capital account. He said that 2 acres of land adjoining the works had been purchased; and there was now sufficient land to meet the necessary enlargements for some years to come. This had cost £1300. The sum of £6890 under buildings, storage, &c., was the additional expenditure in the erection of a new retort-house, with up-to-date plant. The house was put into action in December last, and was capable of producing about 1 million cubic feet per day. On new mains, £1250 had been spent; but service-pipes were all now charged to revenue. The outlay on new meters and stoves was £1927; but the depreciation of £1829 practically wiped-out the capital charge. There was a debit balance on the account of £7367; but the proprietors had received notice that 400 "C" shares were to be sold by auction next day, and subsequently £3800 of 4 per cent. debenture stock would be issued. In regard to the revenue account, the gas-rental showed the satisfactory increase of £2464 as compared with the corresponding period of the previous year, and amounted to £22,711. The meter, stove, and internal fittings revenue had advanced by £313. In this department, 314 cooking-stoves and 284 gas-fires and radiators had been fixed during the half year. The higher prices of residual products, together with a slightly greater production, had raised the receipts for these commodities to £5503, which was an increase of £1025 compared with the December half of 1911. The total receipts amounted to £31,036—an increase of £3809. Passing to the expenditure side, there had been spent on coal, oil, and coke, to meet the increased sale of gas, £1068 more. Including the item for new services and prepayment fittings, which had hitherto been charged to capital, the maintenance, renewal, and depreciation amounted to £2418 more. All the other items of expenditure exhibited an increase, with the exception of rates and taxes, which were £180 less, owing to readjustment with the previous half year. The total expenditure for the six months, including depreciation, had been £23,030—being an increase of £3584. The profit had amounted to £8005, which was an increase of £225. After payment of the several dividends recommended by the Directors, meeting the debenture interest, and adding £514 to the reserve fund, there would be £328 to carry forward. This, added to the previous balance, made a total of undivided profit in hand

of £6082. With the addition of the above amount, the reserve fund would be £5123. The increase in the sale of gas, compared with the corresponding period of the preceding year, was 15,063,000 cubic feet. This was equal to 12·19 per cent. The capital account in relation to production, notwithstanding the large expenditure, had been further reduced; and it now stood at 17s. 8d. per 1000 cubic feet of gas sold. The Directors, as the proprietors were aware, had deposited a Bill in Parliament for further powers. It was now just ten years since the last Act was obtained; and it was interesting to note the growth of the Company during this period. In 1902, the quantity of gas sold was 84,770,000 cubic feet; while in 1912 it was 269,464,000 cubic feet. In 1902, the number of consumers was 2446; last year the number was 10,702. In 1902, the number of cooking-stoves on hire was 630; in 1912, 6001. In 1902, the capital was equal to 26s. 9d. per 1000 cubic feet of gas sold; last year it was 17s. 8d. In 1902, the total capital expended was £114,000; last year, £238,000. In 1902, the rental of meters, stoves, and fittings amounted to £1016; last year to £5369. In 1902, the price of gas was 4s. 3d. per 1000 cubic feet; last year, 3s. 4d. In 1902, the quantity of coal carbonized was 6156 tons; and the amount of oil used was 90,106 gallons. Last year the amount of coal carbonized was 15,644 tons; and the oil used was 170,243 gallons. The dividends paid in 1902 were at the rate of 8 per cent. per annum on the "A" shares, 7 per cent. per annum on the "B" shares, £5 12s. per cent. on the "C" shares, and on the guaranteed shares 6 per cent.—a total distribution of £5453. For last year the rates of dividend were 11 per cent. on the "A" shares, 7 per cent. on the "B" shares, £7 14s. per cent. on the "C" shares, and 7 per cent. on the guaranteed shares—the total distribution being £12,127. In 1902, the amount carried forward was £1600; while the corresponding amount for last year was £6082. There was no reserve fund in 1902; now it stood at £5123. Co-partnership in 1902 was non-existent; for last year there was a balance in hand of £576. In 1902, the total revenue was £22,145; last year it amounted to £60,386. The total of the wages list in 1902 was £3122; last year, the amount was £8558. The length of gas-mains in 1902 was 59 miles; last year, 94 miles. In 1902, the rates amounted to £910; last year to £2623. It should be remembered that, during the whole ten years, the Company had had the services of only one Engineer and Manager, who was with them that day. The Directors were confident that the proprietors would join them in heartily congratulating Mr. Chapman upon the steady growth and success of the Company.

The DEPUTY-CHAIRMAN (Dr. Glaisher) seconded the motion.

Mr. PARDY expressed his pleasure at seeing the Company had a good stock of coal. He also asked what proportion of carburetted water gas was mixed with the supply.

Mr. CHAPMAN: About 33 per cent. We like to keep the composition of the gas as uniform as possible.

The motion was unanimously carried.

On the proposition of the CHAIRMAN, seconded by the DEPUTY-CHAIRMAN, dividends were declared at the rate of 11 per cent. per annum on the "A" capital, £7 14s. per cent. on the additional "C" capital, and of 7 per cent. on the additional "B" capital and guaranteed shares, all less income-tax. It was pointed out by the Chairman that the dividends were rather higher than twelve months ago.

The Chairman was re-elected a member of the Board, on the motion of the DEPUTY-CHAIRMAN, seconded by Mr. A. F. PHILLIPS; and the retiring Auditor (Mr. James Randall) was reappointed, on the proposition of Mr. W. RICHARDS, seconded by Mr. F. R. SMITH.

Mr. A. F. PHILLIPS moved a vote of thanks to the Engineer, staff, and workmen. He remarked that Mr. Chapman had had a very anxious time in transferring the carbonizing work to the new retort-house in the depth of winter. But, under his direction, it was done exceedingly well; and the whole plant was working with the greatest amount of satisfaction. The statistics the proprietors had heard would have convinced them that Mr. Chapman's administration was greatly for the benefit of both proprietors and consumers; his endeavour always being to study their mutual interests. Their Engineer was seconded by a very capable Manager at the works, and an excellent staff in the office—all worked with the utmost loyalty.

Mr. SAMUEL CUTLER seconded the motion; remarking that the figures were eloquent testimony of what Mr. Chapman did. He (Mr. Cutler) had known the Company from its inception, and had had much to do with the works from time to time. He could speak in the highest terms of the technical side of their affairs.

The proposition was unanimously carried.

Mr. G. BARTER asked whether the Board had considered the question of taking up the electric light. He was sure they could furnish a supply better than was now done. He was in another company, which supplied both gas and electricity; and it paid.

Mr. CHAPMAN, in reply, observed that the present accounts were the best the Company had ever had; and he looked to the present half year being better than the past one. They had transferred the works, and certain expenses (which engineers understood so well) that came upon repairs and maintenance during alterations would not be repeated in the present half year, nor for some half years to come. He was glad his assistant had been included in the vote. He was one of the best; and as to the staff, he (Mr. Chapman) had brought them up from lads. Regarding the question of electric light, they could not touch that in Harrow. It was in the hands of the schoolmasters; and they were working it very well. They were paying about 5 per cent. dividend, after putting by a proper amount for depreciation. The two Companies worked amicably; and he did not think the Gas Company wanted to step into the shoes of their neighbours. Happiness ruled amid the vigours of both; and they were going on well and prosperously.

Proposed by Mr. J. E. LILLEY, and seconded by Admiral ROBINSON, a cordial vote of thanks was also passed to the Chairman and Directors.

The Bill in Parliament.

A Special General Meeting was then held to consider, and if thought fit to pass, a resolution approving of the Bill in Parliament, and authorizing the Directors to proceed with it.

The CHAIRMAN explained that the Bill contained clauses for the consolidation of the whole of the share capital into a 5 per cent. standard consolidated stock. The "A" and "C" shares would be as at present dependent on the price of gas. The "B" shares, which had received 7 per cent. since 1883, were to be joined with the guaranteed stock into a 5 per cent. preference stock. The consolidation had been carefully considered by the Directors; and they had had the advice of Mr. William Richards, who thoroughly agreed with the scheme. The Directors were of opinion it would be in the best interests of both the consumers and the shareholders. A second feature of the Bill was that they sought to obtain the necessary powers for the construction of works, and for the manufacture of gas upon the land lately purchased. Various general clauses were also included. A third special object of the Bill was to obtain, in the interests of the employees, leave to set apart a portion of the profits for the benefit of the older servants, and simplify the transfer of stock at the death of a co-partner.

Mr. SEAGER BERRY (Parliamentary Agent) then explained the Bill.

The CHAIRMAN next moved, and the DEPUTY-CHAIRMAN seconded, a resolution, approving of the Bill, and authorizing the Board to proceed with its promotion.

There was some discussion, in the course of which Mr. KIRBY seemed a little doubtful as to whether the interests of each class of proprietor had been properly safeguarded. Mr. J. W. BUCKLEY, on the other hand, regarded the proposals as being in the best possible interests of the Company. Mr. FREEMAN-BARRATT urged that there ought to be more time for the consideration of the schemes by the proprietors. The last-named gentleman also asked quite a number of questions. Mr. BERRY, in reply, gave ample assurance that the interests of all classes of shares were safeguarded; and Mr. RICHARDS supplemented what he had to say. On one point raised by Mr. Freeman-Barratt, Mr. BERRY said that last session the Treasury were quite satisfied that the proposals for pensions and gratuities to employees were in no way overlapped by the National Insurance Act; and the Treasury, after the question had been raised, allowed the Bills to proceed that dealt with such matters as pensions and gratuities.

The motion was carried; and the proceedings then terminated.

BARNET DISTRICT GAS AND WATER COMPANY.

A High Gas Make Per Ton—Increased Dividends.

The Half-Yearly Meeting of this Company was held on Feb. 27, at the Holborn Restaurant, High Holborn, W.C.—Mr. ALFRED H. BAYNES presiding.

The SECRETARY (Mr. Ernest W. Drew) read the notice calling the meeting; and the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN, in moving their adoption, said he should only detain the proprietors for a brief time in calling attention to some of the special figures. The expenditure, under the head of gas capital, had been £2831—being principally for extensions at the gas-works. The expenditure, on account of water capital, had been £3742, £2100 of which was in connection with duplicate machinery at the Tyttenhanger pumping-station, and £1591 for extensions of mains to areas in the Company's limits not previously supplied. The total revenue from the sale of gas, including the rental of meters and stoves, was £17,094—an increase of £870 over the corresponding half year. As the price of gas in the corresponding half year was 2d. per 1000 cubic feet more than in the past half year, he thought the increase in revenue was very satisfactory, and was, of course, due to the increase in the quantity of gas sold—viz., 8,500,000 cubic feet, or above 10 per cent. The receipts from residuals showed a slight decrease—viz., £120. This was due to less coal having been carbonized; part of the make of gas having been from the oil-gas plant that had been recently installed. The expenses of manufacture exhibited an advance of £580; the additional make of gas being nearly 6,500,000 cubic feet, or 7 per cent. The make of gas per ton of coal carbonized was 13,426 cubic feet; and the gas accounted for per ton of coal used was 12,506 cubic feet. The distribution charges had increased by £219; but the amount spent under this heading, and in the renewal of old mains, &c., had probably been instrumental in reducing the quantity of the unaccounted-for gas. The other items did not vary very much from those in the corresponding half year. The net amount carried to profit and loss account equalled £4860—a decrease of £126. The receipts from water-rents, &c., had increased by £543; and the expenditure had decreased by £797—the increase in the balance carried to profit and loss account being £1340. There had been a slight decrease in the quantity of water required in the district; but the demand for this, of course, varied with the conditions of the seasons. Regarding the contingency fund, the sum of £3000 had been written-off for disused and old plant at the gas-works; and the balance to be carried forward, after a credit of £1500 from the profit and loss account, was now £4061. The balance of undivided profits brought from the previous year—viz., £19,679, together with the profit on gas, water, and fitttings, £17,346—gave a total credit of £37,025; and after the payment of income-tax and interest on loans and debenture stock (£2760), and transferring £1500 to the contingency fund, a balance remained on profit and loss account of £32,764. As was stated in the report, in view of the excellent result of the half-year's accounts, the Directors felt justified in recommending an increase of ½ per cent. in the dividend on the "A," "B," and "C" stocks—that was to say, on the "A" and "C" stocks, 8½ per cent., and on the "B" stock 7½ per cent.—and an increase of 7s. per cent. on the "D" stock, making it £5 19s. per cent. After payment of these dividends, the balance to be carried forward would be £20,135—an increase of £457 on the amount brought forward at the commencement of last half year. The Directors felt sure the proprietors would share with them the gratification they felt respecting the continued prosperity of the Company. The only circumstance that marred the prospect was the high prices of all materials which were necessary for the Company's operations; and this especially applied to coal. The increase in this alone would amount to a very large sum; but the Directors were confident the growth of the district, and the increase in the business of the Company, would enable them to meet

the temporary increased charges. The proprietors would, he thought, agree with him in regarding the report before them with great satisfaction, recording, as it did, most gratifying progress in both departments, notwithstanding very considerable difficulties of the half year. Nor should it be forgotten that these satisfactory results were mainly due to the able management of their Engineer (Mr. F. J. Bancroft), and the assistance of the valuable staff working under his direction.

The Deputy-Chairman (Dr. J. W. L. Glaisher, F.R.S.), seconded the motion, which was unanimously carried.

On the proposition of the Chairman, seconded by the Deputy-Chairman, dividends were declared, less income-tax, at the rates of 8½ per cent. per annum, on the "A" and "C" stocks, 7½ per cent. on the "B" stock, and £5 19s. per cent. on the "D" stock.

Mr. Alfred Lass moved the re-election of the Chairman and Deputy-Chairman, who were the two Directors retiring by rotation. He remarked that the proprietors ought to be thankful that they had two gentlemen like Mr. Baynes and Dr. Glaisher at the head of their affairs.

Mr. Pardy seconded the motion. In doing so, he commented on various items in the accounts, and reply was made, as will be seen later, by Mr. Phillips.

The motion was unanimously agreed to.

Mr. Laurie Andrews proposed the reappointment of the retiring Auditor (Mr. C. P. Crookenden); and, Mr. Buckley having seconded the motion, it was adopted.

Mr. A. F. Phillips, proposing a vote of thanks to the officers and staff, remarked that they had in Mr. Bancroft an Engineer capable of managing not only the water-works, but the gas department; and the results he obtained were second to none of any other works. In Mr. Drew, they had a Secretary who was most keen in the Company's finances, and kept the Board informed of all that was going on. In all the other members of the staff, the Company were exceedingly well served. He might perhaps say a few words with reference to the remarks of Mr. Pardy. The reason why the finances of the gas undertaking were not quite so good as in the previous half year was the reduction by 2d. of the price of gas. The water undertaking was undoubtedly the most beneficial part of the Company's concern. It must, however, be remembered that the area supplied with water was much larger than that supplied with gas; and, in the water area, they had the richest part—Finchley. If the Company's powers had included the supply of the area with gas as well as with water, the revenue account would present a very different appearance. The reduction of the pumping charges was entirely due to the more efficient machinery at Tyttenhanger; and this was not in use twelve months ago. With regard to the reservoirs, they were of substantial construction, and were entirely well maintained. The Company were subscribers to the British Commercial Gas Association; and he wished he could say the same of all gas companies.

Mr. Griffin seconded the motion, which was heartily agreed to.

Mr. Drew, in acknowledging the vote, remarked that the officers of the Company needed no incentive to continue their loyal work. If any incentive were required, it would be supplied by the half-yearly vote of the proprietors.

Mr. F. J. Bancroft, in thanking the proprietors, remarked that the Company had just touched 100 million cubic feet of gas made in the half year; so that they would soon be a 200 million cubic feet per annum works. Their district, which was a large one, was developing at the extreme ends. They had development in the north at Mimms, and quite in the south part of the district (near Finchley), which had been unpopulated, they had a large number of houses being constructed. Tyttenhanger continued to give a good yield of water; and their former critics now confessed that the Company were providing a good supply throughout the district. All these circumstances had added to the anxieties of the management and to the work of the staff. The staff had responded well to the call; and, on their behalf and his own, he thanked the proprietors very much for their recognition.

Moved by Mr. W. Richards, and seconded by Mr. Mackworth Wood, the Directors were heartily thanked for their services.

The Chairman responded on behalf of himself and his colleagues.

GOOD POSITION AT NEWMARKET.

The shareholders of the Newmarket Gas Company learnt at the recent annual meeting that during the past year 88 new customers had been placed upon the books, and a large number of cookers, radiators, and gas-fires fixed. The works and plant, under the supervision of Mr. J. H. Troughton, the Manager and Secretary, were in an efficient condition, and capable of dealing with any reasonable increase of business. The amount standing to the credit of the profit and loss account was £7555; and the Directors recommended a dividend at the rate of 6¾ per cent. on the original consolidated stock, less income-tax. This would absorb £3813, and leave £3742 to be carried forward. The Chairman (Mr. R. Stephenson, J.P., D.L.), in moving the adoption of the report, referred to the additional customers secured during the past year, and remarked that many of them were, of course, small ones. They knew, he said, that gas was the poor man's as well as the rich man's light, and that the working men were now coming day by day more to understand the advantages of gas as the most useful thing for every lighting, and in many cases for every heating and cooking purpose. The working men were now, he thought, the sheet-anchor of most gas companies. The report was adopted. Replying to a vote of thanks passed to him, Mr. Troughton congratulated the Chairman, Directors, and shareholders on what he considered the excellent prospects of the gas industry, which he said were never brighter than to-day. He had seen reports of various gas companies, and all seemed to be paying maximum dividends; and he did not know a gas company which had reduced its dividend in the last ten or twenty years. This was extremely satisfactory to investors. If the Newmarket Company lost the whole of their lighting, he was sure they would be able to pay a substantial dividend, as they sold more gas in the daytime than at night. At the close of the meeting, those present were shown over the works by Mr. Troughton, and found the visit very interesting.

JOHN WRIGHT AND EAGLE RANGE, LIMITED.

The Ordinary General Meeting of this Company was held at the Grand Hotel, Birmingham, yesterday—Mr. H. James Yates, F.C.S., the Chairman and Managing-Director, presiding.

The Secretary (Mr. Brunton Peattie) having read the notice convening the meeting, the Directors' report, the main portions of which were given in the "Journal" last week (p. 625), was presented.

The Chairman, in moving the adoption of the report and accounts, expressed his particular pleasure in doing so, because, notwithstanding that in recent years the Directors had been able to inform the shareholders that each year had proved a record as compared with its predecessor, the one under review was, both as regards turnover and profits, far and away the highest in the history of the Company. While, however, they could congratulate themselves on this satisfactory state of affairs, there were circumstances which could not safely be ignored. Though the profits showed a further improvement, this was by no means proportionate to the increased turnover. Notwithstanding all the labour-saving appliances which had been installed, and the numerous devices adopted for minimizing costs, these showed a considerable increase. The wages paid were higher, and all raw material had gone up considerably in price. It was true that an advance had been obtained from their customers; but unfortunately this, in many instances, did not cover the enhanced costs. The Company had consistently adopted the policy of creating and maintaining a contingent reserve; and he could not too strongly emphasize the wisdom of so doing. It was largely due to the fact of their having good reserves and an ample margin of cash in hand, that they were able to conduct the business with so much success. The Chairman next referred to the present serious relations existing between capital and labour, and said he was convinced that the tendency to-day to settle every dispute by means of a strike was radically wrong. If either side, in such controversies, could put themselves in the other's place, and take a comprehensive view of the situation, each being prepared to give a fair market value in work or in wages, there would be less cause for discontent. Unless workpeople were prepared to act in a far more reasonable way than had recently been the case, then, for the Company's part, notwithstanding that they had built very large works, they would be compelled to establish others abroad for the purpose of manufacturing certain portions of their goods. This would mean the closing-down of a great part of their works in this country, and the throwing out of work of many hundreds of employees. After a few remarks on the unfortunate almost entire disappearance of the apprenticeship system, the Chairman spoke as follows.

The Work of the British Commercial Gas Association.

Many of you have, no doubt, noticed advertisements that have been appearing in the various papers and magazines pointing out the important advantages of using gas as a fuel for various domestic purposes. These advertisements emanate from the British Commercial Gas Association—a body which has been formed by the combination of most of the gas undertakings and the manufacturers of gas apparatus in the United Kingdom; and, indeed, it is receiving financial support from a number of gas companies in the Colonies. As I have been closely associated with the formation and the working of this body, I should like to take this opportunity of telling you what valuable work it is doing, and how it has already been the means of awakening in the public a knowledge of, and a practical interest in, these various uses of gas. I consider that the exceptionally good results of our last year's trading have been greatly assisted by the first year's operations of this Association; and I am convinced that as its funds grow, it will be a means of extending the use of gas, and consequently of gas apparatus such as we manufacture, to a degree far beyond anything hitherto anticipated.

The Forthcoming National Gas Exhibition.

Another very important part of this general forward movement in the gas industry is the holding of a National Gas Exhibition in London in October next. A large section of the White City has been secured for this purpose; and as the exhibition will be run on lines altogether new in the history of industrial gas exhibitions, it is anticipated that it will give an impetus to the gas industry such as it has never before received. The old method of having competitive exhibits of various appliances has been entirely abandoned, and there will be a display of all forms of gas apparatus, whether for lighting, cooking, heating, or the supply of hot water, &c., under conditions approaching, as near as possible, to those of every-day use. I hope that as many of our shareholders as possibly can will take an opportunity of visiting what will be far and away the most interesting exhibition of the kind that has ever been held.

The Firm's Improvements in Gas Apparatus.

I referred last year, at some length, to our pioneer research work in connection with gas-fires. When a number of years ago, as the result of my research work, I discovered the causes of the defects in the gas-fires of that day, I took out a patent; but it turned out that, notwithstanding the fact that the Patent Office had accepted my patent and received the yearly fees for renewal, I was advised by counsel that, in spite of the value of the invention from the point of view of utility, there were extreme doubts as to whether my patent would be upheld by the Courts. If the patent laws of this country were so framed as to prevent a patent being granted unless it were the intention of the authorities to afford the patentee protection from infringement, there is hardly a maker of gas-stoves to-day who would not be called upon to pay your Company a royalty on every fire that is made by them. Our gas-fire radiants—that is, the refractory fire-clay material heated to incandescence by the gas—are the type we evolved several years ago after prolonged research work, and still maintain supremacy after standing the test of four successive winters. These radiants, which give the highest efficiency of any radiants made—a fact corroborated by independent scientific tests made by a number of highly qualified investigators—are being adopted by gas undertakings as the standard radiant; and other gas-stove makers are having to adjust

their patterns to take our radiants. During the past year, we have made a further big development in gas heating by introducing a construction of gas-grates which are intended to be built-in in place of the coal-grate; and I look forward to the time, not so far distant, when architects and builders will be compelled, as the result of the public demand which we have set ourselves to create, to build-in gas-grates instead of the ordinary type of coal-grate, which has the habit of pouring volumes of smoke into the atmosphere, to the detriment of the health of the occupants. This development of the gas-fire, and its wider application, will doubtless do much to solve the smoke problem.

GAS-FIRES IN INCREASED FAVOUR.

Not so many years ago, few were more opposed to the use of gas-fires for domestic purposes than doctors; but to-day we have no more effective advocacy of gas-fires than is afforded by the medical profession, where means have been taken to prove to them that a properly constructed gas-fire is thoroughly hygienic, and has all the advantages of the coal-fire without any of its disadvantages. One result of this recent propagandist work is that in one single district there are, to my own knowledge, thousands of our "Thermo X" gas-fires in use in the houses of medical men themselves. The idea as to the necessity of placing a bowl of water in front of the gas-fire is rapidly passing away; there being, of course, no need for any such provision with the modern gas-fires invented by this Company, as these are so designed as to give off the greater part of their heat in the form of radiant heat, which all medical and other leading scientific authorities now agree in regarding as the most healthy and agreeable form—it being, in fact, the same natural form of heat as that of the sun's rays. The old type of gas-fire gave most of its heat by convection—that is, by the air getting heated through contact with the hot metal. But the hotter the air, the more moisture it absorbs; and hence the dryness of throat and skin which such fires caused. But at the same time, the walls, not being sufficiently warmed, abstracted heat from persons near them, and a chilly feeling was the result. The overheating of the air of the room, with the high-temperature convection to be found previously in all types of gas-fires—and in a greater or less degree even in some types of gas-fires still on the market to-day—has for a number of years been a thing of the past so far as our fires are concerned, and so are the ill-effects of the former types of gas-fires to which I have referred. There is a constant source of credit and advantage to the Company in the wide public knowledge that we were the discoverers of the causes which rendered the former types of gas-fire objectionable; and that we were the first to impress on the medical profession and the public the principle that gas-fires should concentrate chiefly on radiant heat, and that less convected heat should be given off, and that at a low temperature only, so as not to unduly dry the air. It is to the introduction of our "Thermo X" gas-fires, embodying these new ideas, and to our persistent educating of the public in the principles I have indicated, that is largely due the rapid change that has occurred in the popular attitude towards gas heating, despite the cold water which was at first poured on our proposals. And it is owing to these same inventions and efforts of our own that gas-fires are to-day being sold in great and growing quantities, not only by ourselves, but by other makers, who have, as I have already said, had to come round to our views and methods.

THE POSITION OF THE COMPANY.

The Chairman closed his speech by dealing with the financial position of the Company at the end of the past year, and offering comments upon some of the figures in the balance-sheet.

Mr. G. G. Brodie seconded the motion; and it was carried.

RICHMOND GAS STOVE AND METER COMPANY.

When proposing the adoption of the report (*ante*, p. 626) at the annual meeting at Warrington last Thursday of the Richmond Gas Stove and Meter Company, Limited, the CHAIRMAN (Mr. Thomas Dwerryhouse) said they had had a prosperous year. The year they were now entering upon was one in which they had for the first time to bear for the twelve months the heavy charges of the Insurance Act and a considerable increase in the wages of the men employed. Also contracts for materials would be at higher prices; and though increased charges were being obtained from customers, these would not adequately cover the extra cost. With care, however, he hoped a satisfactory year would result.

In seconding the resolution, Mr. H. M. THORNTON (the Vice-Chairman and Managing-Director) remarked that 1912 had proved a record year for turnover. As a result of this greater business, the profit was also larger; and, as the balance-sheet showed, the financial position had been materially strengthened by additions to the reserve and depreciation fund. There were several reasons for the Company's continued prosperity; but primarily they might attribute it to the work done by them for many years in the way of advertising—not only of their own particular manufactures, but also the educational work they had accomplished by means of gas exhibitions, canvassing, show-rooms, &c., which had brought prominently before the public the many uses of gas for cooking, heating, industrial, and other purposes. Another factor which had been responsible for the larger business was the British Commercial Gas Association. This Association, which was formed in 1911, had for its object advertising the uses of gas for all purposes. It was formed by the gas companies and corporation gas departments, with the hearty co-operation of makers of apparatus used in gas manufacture, and of the suppliers of the necessary goods for the use of gas after it was made. The Association's funds continued to grow, and were spent on advertising in the daily papers, periodicals, and the technical and educational press; and as time proceeded and the income of the Association grew, it would be possible to extend its scope for good in many directions. The Association had a General Committee and an Executive Committee controlling its policy, of both of which he had the honour to be a member. This bringing together of both sides of the industry had proved to be a great power for good. It had broken down prejudices, improved the relations of buyer and seller, and had been responsible for an enthusiasm for the advancement of the industry which augured well for the future, and which had astonished even those who were most optimistic in the formation of the Association. One other reason for the Company's present prosperity was the recognition in the gas world which they had obtained for the production of reliable and scientifically constructed goods. In this connection, the growth of their research work had been so considerable that Dr. Harold G. Colman, who had been their Consulting Chemist, and who had a very large practice, felt he must relinquish the position, and strongly recommended them, in view of the growth of the work, to appoint a fully qualified chemist to take control of the laboratories and devote the whole of his time to analytical and research work. This had been done, and Mr. Harold Hartley, M.Sc., and late Gas Research Fellow, Leeds University, and Gartside Scholar, Manchester University, was now with them. The Board felt that they had been fortunate in securing his services. The responsibilities and importance of this position would be realized when he mentioned that an even more rigid and exacting standard had been established in the laboratories and throughout the works, to ensure that everything placed on the market would give the utmost satisfaction, not only to the buyer but to the consumer. A further contribution to the success of the business was the addition in recent years of departments for the manufacture of gas apparatus other than cookers and fires. One of the most successful of these departments was that concerned with the manufacture of industrial appliances. The Company's natural-draught as well as their blast furnaces, which incorporated valuable patents, gave heating efficiency results which were greatly in advance of anything which had yet been produced. Another department to which they were looking to give them a considerable business was that of appliances for water heating. It would be seen, therefore, that the Company were fully alive to the possibilities and requirements of the gas industry, and were thoroughly equipped and well organized to take a leading part in all further developments. Much that was new would be shown, not only by them, but by all apparatus manufacturers, at the National Gas Exhibition to be held in London in October. Here, again, as in the case of the British Commercial Gas Association, both sides of the industry were combining to achieve what promised to be a very successful and unique effort.

The report was adopted, a dividend at the rate of 10 per cent. per annum was declared (with a bonus of 6d. per share), free of income-tax, and votes of thanks were passed to the Chairman, Managing-Directors, Secretary, and staff.

Mr. JOHN RANSOME (Managing-Director), in responding to the vote of thanks to the staff, referred to the capable staff which had grown around them, and to the whole-hearted co-operation of the men during the troublesome times experienced during the year.

SELBY WATER-WORKS EXTENSION.

Local Government Board Inquiry.

An inquiry was held last Wednesday, by Mr. M. K. North, M.Inst.C.E., on behalf of the Local Government Board, into a proposal of the Selby Urban District Council to acquire the whole of Brayton Barff, a wooded hill four miles to the eastward of the town. The Barff forms part of the Earl of Londesborough's property, and is in the market with other portions of his lordship's Selby estate. A remarkable offer had been made to the Council for the sale of the Barff, about 75 acres in extent, at the low price of £600, for the purpose of extending the water-works. It is proposed to provide an additional storage reservoir, and to use the other land as a protection area. There was no opposition to the application, which was for sanction to borrow £650, and to spread the repayment over sixty years.

The Clerk to the Council (Mr. J. H. Bantoft) stated that an acre at the top of the Barff was occupied by the present storage reservoir erected in 1905. The Rural District Council served four villages from the Urban District Council's supply, and were considering extending their mains to other parishes. The Consulting Water Engineer to the Council (Mr. Percy Griffith, M.Inst.C.E.) and Professor Kendall both recommended the purchase. The land was freehold, and the only reservation was the minerals. The purchase price for the 75 acres was £600. The Barff was formed by an outcrop of the new red sandstone, and with the few fields adjoining formed the gathering-ground of the present supply.

The Medical Officer of Health (Dr. Stedman) gave general support to the scheme; and Mr. R. J. Foster and Mr. T. Liversidge, as large ratepayers, favoured the proposal.

Mr. R. Bruce Gray, the Surveyor and Water Engineer to the Council, said the present consumption was about 300,000 gallons per 24 hours, and the existing reservoir had a capacity of 820,000 gallons. They had plant for supplying 26,000 persons, but were actually only serving 12,000, including the rural districts. Mr. Gray mentioned, in reply to the Inspector, that the present site which they had on the Barff consisted of about 6¼ acres, and cost £1500. The remaining 75 acres would cost about £600. They would probably let the sporting rights. If they found it desirable to cut across the fall of the strata, which dipped to the eastward, they would probably drive adits a considerable depth and catch the water as it fell.

Prosperity at Watford.—Addressing the shareholders at the half-yearly meeting of the Watford Gas Company, the Chairman (Mr. E. J. Slinn) said they had to congratulate themselves on a satisfactory six months. The sale of gas had realized £17,000, which was a 10 per cent. increase; and residuals had done very well indeed. The total balance on profit and loss account was £7848—an increase of £62 when compared with the corresponding period of the previous year. The report was adopted, and dividends were declared at the rate of £7 7s. 6d. per cent. per annum on the "A" capital and £5 17s. 6d. per cent. per annum on the "B" capital, both less income-tax. A vote of thanks to the staff was acknowledged by Mr. J. Duncan Royal, the Secretary and General Manager.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The wisdom of the Council of the Western Division of the Scottish Junior Gas Association, in going outside the ranks of the gas profession for the reader of a paper, was shown at the meeting on Saturday by the large attendance of the members, and by the fact that several seniors travelled considerable distances to hear the communication. The interest shown, and the fact that at so many works vertical retorts have been installed, lead to the belief that it would be of much advantage if one of the Senior Associations, if not the Institution of Gas Engineers itself, were to try to obtain a paper on the use of the vertical retort for oil making from one of the acknowledged heads of that industry. The two businesses of oil making and gas making have much in common; and from the long experience of the vertical retort working which the oil manufacturers have had, much information and many useful tips could, no doubt, be obtained by those who are studying and advancing the methods of improving the carbonization of coal. Probably, from the very difficulties which the oil maker has had, more will be learnt than from the successful working, as what would be good working for a gas-retort—viz., the making of permanent gases—would be exactly what should be avoided, as far as possible, in an oil retort. Thus the paper might treat of causes of failure as well as of the approved results; and as these have been generally watched by men of a scientific training, and who at the same time have had the most potent aid to practical working—the necessity of reducing the costs to a minimum—the paper might easily be of enormous value.

Mr. M'Killop's paper will be read by all in the gas profession with interest, as it was of a truly practical nature, and detailed the working and the results in a way which made it specially useful to the audience, and also to those who will now have the opportunity of gleaning its import from what appears in the "JOURNAL." The description of early work and later improvement were all lessons to be carefully studied; and the paper by the late Mr. William Young, read before the North British Association of Gas Managers in 1883, mentioned by Mr. Waddell, will well repay perusal. It was also fitting that Dr. Beilby's article in the "Journal of the Society of Chemical Industry" should be mentioned in the Technical College, where the meeting was held, as he is the Governor of that Institution. The discussion was well sustained. The Seniors were wisely kept to the last, and the Juniors were thus not made to feel that all the points they wished to touch upon had already been debated by those better able to deal with them. Mr. John Wilson is also to be complimented upon his conduct in the chair, which he occupied in the absence of the President.

Alloa.—The plans for the new retort-house for the Corporation Gas-Works at Kelliebank have been passed by the Dean of Guild Court. The plant will include twenty-four vertical retorts, 23 feet in length each; and it is expected that the new installation will only require one-third the number of men at present employed at the retorts. A saving in wages to the extent of over £1000 a year will thus be effected.

Buckhaven.—The monthly meeting of the Buckhaven Town Council was held on Monday evening—Provost Rose presiding. The minute of a meeting of the Committee appointed to inquire into the question of a municipal gas-works was submitted, and Councillor Smart, seconded by Councillor Gillespie, moved approval. Bailie Taylor moved an amendment that the minute be left over till they obtained some further information. Asking the Council to approve a report which they had never seen was not good business. The Gas Committee had a report from Mr. Henry O'Connor; but they also thought it advisable to obtain Counsel's opinion on certain matters, and until they got this opinion he moved that the report be held over. Mr. James Galloway moved that the Gas Committee, in addition to their present duties, be given power to inquire as to the practicability of introduing electric power into the burgh, and report. This was also agreed to.

Dumbarton.—The Eastern District Committee of the Dumbarton County Council have been considering the request for the formation of the Cumbernauld water supply district, and the petition from the ratepayers in Smithston, Condorrat, and Croy that they should be included in the district. The District Committee decided not to form such district at the recommendation of the local Committee.

Hamilton.—Two men from Hamilton and Blantyre have received thirty days' imprisonment for having broken into empty houses in different parts of Burnbank and Hamilton, and abstracted 25s. from slot gas-meters on different occasions between Nov. 28 and Jan. 7.

Helensburgh.—Mr. Tatlock has been testing the gas in Helensburgh, and found at a test made in the forenoon a quality of 17-candle power, and in the evening of 19·5 candle power. The Convener of the Gas Committee, at the monthly meeting of the Town Council on Friday, stated that this satisfactory report would restore confidence on the part of the public. If, however, the gas was varying as much as 2½ candles between the day and the night, it would appear that the consumers had cause for complaint, as inverted burners which were suited for the lower quality would certainly not be satisfactory when the richer gas was being supplied. The public office at the gas-works is to be rebuilt at a cost of £450.

Inverkeithing.—At the monthly meeting of the Inverkeithing Town Council on Friday, Mr. Robertson gave notice of motion for next meeting to the effect that the Council adopt the Burghs Gas Acts, and proceed in the meantime to negotiate with the Inverkeithing Gas Company for the purchase of their undertaking.

Kirkcaldy.—Whether gas should be displaced by electric light at the harbour is a matter which has had the attention of the Harbour and Foreshore Committee of the Kirkcaldy Town Council. The question is one of cost. The Harbour Master has submitted an account for £69 6s. 11d., which represents the cost of the gas consumed from Nov. 6, 1912, to Jan. 27, 1913; while mantles for the same period have

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cost £35 1s. 4d. In view of the heavy expenditure, the Committee have asked Mr. Francis, the Manager of the Electric Lighting Department, to submit a report on the probable cost of introducing electric light, and also as to the probable cost of upkeep. The proposal to extend the Kirkcaldy Gas-Works has aroused considerable opposition among the ratepayers, many of whom are strongly favourable to the works being rebuilt on a new site outside the town; while several of the councillors argue that, allowing extension to be necessary, this new site would be more profitable, and also beneficial to the health of the burgh. At a meeting of the Gas Committee, a comparative statement was submitted by Mr. Kincaid, the Gas Manager, in which he showed that, owing to increase in the cost of coal and labour, they would have required to raise the price of gas by 2d. or 3d. per 1000 cubic feet but for the balance in hand. If the proposed extension were carried out, however, the saving so effected would enable them to dispense with any increase in the price of gas. Should the works be transferred to a new site, as had been suggested, it would probably mean an increase of 10d. or 11d. per 1000 cubic feet of gas.

Stonehaven.—The first statutory meeting of the Stonehaven Gas Company, Limited, which was recently converted into a public Company, was held on Tuesday—Mr. George Gregory, the Chairman, presiding. From the report of the Directors, it appeared that the shares allotted numbered 10,100, of £1 each; and these had been credited as fully paid up in consideration for the whole plant, machinery, and assets of the Stonehaven Gas Company. The adoption of the report was moved by the Chairman, seconded by ex-Provost Torry, and agreed to. The Chairman said he might now state, for the information of the shareholders, that the Company were negotiating for the purchase of a large piece of ground adjoining the works, and had accepted tenders for a new holder of 100,000 cubic feet capacity to be erected on the site. The purifiers, too, would soon have to be renewed. The annual make of gas for the past four years had increased about one million cubic feet, and for the present year, which had still two months to run, the increase had been 1,600,000 cubic feet. This increase was due to a considerable extent to the more liberal use of gas for heating, cooking, and power purposes.

Settlement of the Liverpool Water-Works Rating Dispute.—According to a Liverpool paper, the differences which have for a long time existed between the Water Committee of the Liverpool Corporation and the Corporation of Chorley and the Chorley Assessment Committee, in reference to the question of the rating of the Corporation's water-works in the Chorley Union, have, after prolonged negotiations, involving legal proceedings, had a very satisfactory termination—an agreement having been arrived at between the parties concerned. The terms of settlement, as approved by the Water Committee, were unanimously approved by the City Council last Wednesday, on the submission of the proceedings of the Committee.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 8.

Sulphate of Ammonia.

During the past week there has continued to be little animation in the market, and there have been practically no fluctuations either one way or the other. Dealers with orders for March delivery have not shown any eagerness to cover their requirements, and new business has not been sufficiently extensive to stimulate the tone. The closing quotations remain £14 per ton f.o b. Hull, £14 1s. 3d. per ton f.o.b. Liverpool, and £14 2s. 6d. per ton f.o.b. Leith. There is no new feature to comment upon in the forward position. Producers are still quoting about spot values, and middlemen are willing to operate at rather less money; but few actual transactions have transpired.

Nitrate of Soda.

The market for this material continues quietly steady at 12s. per cwt. for ordinary and 12s. 1½d. for refined quality, *ex* store, for prompt delivery.

LONDON, *March* 10.

Tar Products.

There is not much alteration in the market for tar products. Business is very quiet, and no doubt the high prices are the cause of this. Pitch maintains its price; and there has been a fair amount of business transacted during the past week. Benzols are quiet, though there is a fair amount of inquiry in the market, possibly on account of the idea that this article will be used for petrol; but so far it has not had any effect on the quotation. Naphthas are in fair demand, but without alteration in price. Sales of crude carbolic have been made during the week at lower figures, and consumers expect to see a further reduction. Creosote is very firm, and there is a good number of inquiries for this article both for prompt and forward.

The average values during the week were: Tar, 31s. to 35s. Pitch, London, 50s. to 50s. 6d.; east coast, 49s. 6d. to 50s.; west coast, Clyde, 49s. 6d. to 50s.; Manchester, 49s. to 50s.; Liverpool, 49s. 6d. to 50s. Benzol, 90 per cent., naked, London, 11d.; North, 10½d. to 11d.; 50-90 per cent., naked, London, 10d. to 10½d.; North, 10d. Toluol, naked, London, 10½d. to 11d.; North, 10d. to 10½d. Crude naphtha, in bulk, London, 5½d. to 5⅝d.; North, 5d. to 5½d. Solvent naphtha, naked, London, 1s. 1d. to 1s. 1½d.; North, 1s. 1d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 3⅛d. to 3⅜d.; North, 3⅛d. to 3¼d. Heavy oils, in bulk, 3⅛d. to 3⅜d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 9½d. to 1s. 10d. Naphthalene, £5 to £9; salts, 50s. to 55s., bags included.

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Sulphate of Ammonia.

This market has again been decidedly quiet, and offers from abroad have been quite below the values quoted here. Outside London makes are quoted at £13 6s. 3d. to £13 7s. 6d.; Leith, £14 2s. 6d. to £14 3s. 9d.; Liverpool, £14 1s. 3d. to £14 2s. 6d.; Hull, £14 1s. 3d.; Middlesbrough, £14 1s. 3d.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade is active; there being the usual increase in the demand before the great holidays. The shipments of coal are heavy from the northern ports, both foreign and coastwise; steamers being now in more regular supply. In the steam coal trade, prices are firmer; best Northumbrians being 14s. 9d. to 14s. 10½d. per ton f.o.b. Second-class steams are from 14s. 3d. per ton; and steam smalls are rather scarce at 10s. to 10s. 6d. The output is steady, and is well taken up. In the gas coal trade, there is a full business, and some of the collieries seem barely to maintain their output, so that the price is firmer generally. Best Durham gas coals are 14s. 9d. per ton f.o.b.; and for second-class gas coals 13s. 9d. is the current quotation. For "Wear specials," about 15s. per ton is the f.o.b. price. Of course, there are heavy deliveries being made under the long contracts, which are below the prices just quoted. No new contracts for gas coal are reported this week—to any large extent. But there are inquiries for considerable quantities; and the ease in the freight markets may help to place some sales of gas coals for shipment at slightly lower prices than have of late.

Scotch Coal Trade.

All over the Scotch coalfield the pits are actively employed, and prices are fully maintained. On Friday, on the Glasgow Coal Exchange, the prices quoted were: Steam coal, 13s. 6d. to 14s.; splint, 15s. to 15s. 6d.; ell, 13s. 9d. to 14s. 6d.; trebles, 14s. to 14s. 6d.; doubles, 13s. 9d. to 14s. 3d.; singles, 13s. 6d. to 14s. f.o.b. Glasgow.

Additional Capital for the Colonial Gas Association.—It will be seen, from an announcement which appears elsewhere, that the Directors of the Colonial Gas Association, Limited, are inviting applications, not later than the 17th inst., for an issue at par of 5000 ordinary shares of £5 each, and 60 debentures (5 per cent.) of £100 each. The Company have stations in Victoria, New South Wales, Queensland, and South and Western Australia; and the additional capital is required for carrying out extensions called for by the continued growth of the townships served by the Company, the progress of which is shown by the fact that the dividends paid since 1906 have risen from 5 to 6 per cent. per annum.

Charge against a Collector.

David Lewis, a meter inspector in the employ of the Pontypridd Urban District Council was charged before Mr. D. L. Thomas, the Pontypridd Stipendiary, last Thursday with embezzling about £700, falsifying a receipt and deposit-book, and stealing a sum of £50. It was stated in evidence that a system of checking previously in vogue had been taken off, and that Lewis was paid £2 a week for collecting over £7000 a year for the Council. As to the charge of larceny, the Stipendiary said the prosecution had failed to make this out; and the accused then pleaded guilty to the remaining charges. For the defence, Mr. Bruce said the Magistrates had no power to deal with a case of falsification; but he thought justice would be met by any penalty the Bench would impose in regard to the embezzlement. The Stipendiary thought it would be undesirable to set aside the falsification of accounts; and the accused was remanded for the completion of the depositions.

Sale of Stocks and Shares.

The sale conducted by Messrs. A. & W. Richards at the Mart, Tokenhouse Yard, E.C., last Tuesday contained three new issues of capital by order of Directors. The Harrow and Stanmore Gas Company offered a sufficient number of £10 "C" shares, ranking for a standard dividend of 7 per cent., but carrying, as from the 1st prox., £7 14s. per cent., to produce, with premiums, £5830. The shares fetched £15 7s. 6d. to £15 10s. each. An issue of £10 "B" shares in the Tendring Hundred Water Company (maximum dividend 8 per cent., but present rate 4½ per cent.) realized £10 10s. to £10 15s. apiece; some of the Company's 4 per cent. perpetual debenture stock being sold at par. A parcel of additional ordinary £10 shares in the Lowestoft Water and Gas Company, ranking for a maximum dividend of 7 per cent., but carrying 5¼ per cent. as from the 31st inst., realized £10 2s. 6d. to £10 7s. 6d. each; and some 4 per cent. perpetual debenture stock was placed at 100⅛ to 100⅓ per £100. By instructions of executors, some 6 per cent. "B" preference stock of the Brighton and Hove Gas Company was submitted for competition, and it fetched £126 per £100. Some ordinary stock of the Dartford Gas Company, carrying 5 per cent. dividend, was sold at £96 to £100 per £100.

Wigan Gas Profits and the Rates.—Moving the adoption of the Gas Committee's minutes at the monthly meeting of the Wigan Borough Council, the Chairman (Mr. M. Seddon) said it was estimated that the profits for the year ending on the 31st inst. would be £3500, *plus* £5600 the value of the gas supplied free for public lighting. Out of this the Committee were handing over £2000 towards relieving the general district rate. With regard to a proposed borrowing for the duplication of the carburetted water-gas plant, it was proposed that the Council should pass a formal application for a fixed amount, to include an exhauster. The plant would bring revenue to the town, and be very useful. The minutes were passed, and it was agreed to apply to the Local Government Board for sanction to borrow the sum of £3200.

The Future of the Plate Rack.

OUR last advertisement called attention to our patent **"Universal"** Plate Rack and Back Plate and its suitability for any make or size of Gas Cooker. The importance of this unique idea of **one pattern** suitable for all cookers you may hire or sell cannot be overrated. Your stock of complete racks is reduced to a minimum. Consider it as part of your hiring scheme for cookers. Many companies are now renting these racks from 1s. to 1s. 6d. a year. It pays to please the consumer. It pays to buy the best. The best is the **"Universal."**

Showing "Universal" fixed to Cooker.

The Richmond Gas Stove & Meter Compy. Ltd.,

Gas Apparatus Specialists,

London Offices and Show-Rooms: **132, Queen Victoria Street, E.C.**

General Offices and Works: **Academy Street, WARRINGTON.**

Gas v. Electricity for Cooking.

On Saturday, the 1st inst., the Old Students' Guild of the National Training School for Cookery held a conference at the Royal Sanitary Institute, Buckingham Palace Road; and in the course of the proceedings attention was given to the subject of gas as compared with electricity for cooking. Miss Helen Edden, who opened on behalf of gas, is, as readers may remember, lecturer for the Gaslight and Coke Company; and, as proof of the extent to which gas is now used for cooking, she mentioned that it is estimated that over 3,000,000 gas-stoves are in use throughout the kingdom. She urged that gas makes for quickness and economy in cooking. Replying, Miss Padley, who holds a corresponding position with an Electricity Company, contended that purity, safety, and convenience distinguished the use of this particular form of heat energy. No "noxious fumes" arose where it was used, food could be served uncontaminated by burnt or unburnt gases, and the shrinkage of meat cooked by electricity was very much less than by gas or coal. Indeed, this need not be more than 7½ to 10 per cent. by this force, whereas 25 per cent. was usually estimated when other forms of heat were employed. The question as to which was the better was submitted to the vote of the meeting; but the result cannot be taken as conclusive. For gas, 22 hands were held up; for electricity, 34. The majority, however, said they had not had any experience in regard to electricity, and therefore preferred not to express any opinion.

Weston-super-Mare Gas Company.—The report submitted at the half-yearly meeting of the Weston-super-Mare Gas Company stated that the sales of gas for the six months to Dec. 31 showed an increase over the corresponding period of 1911 of 16,492,400 cubic feet, or 17·54 per cent. The Directors recommended the payment for the half year of the maximum dividend, at the rate of 5 per cent. per annum on the ordinary stock, less income-tax. They stated that they had added £1000 to the reserve fund and £500 to the insurance fund—bringing the former fund up to £9601, and the latter to £3370.

Proposed Additional Capital at Sutton.—An increase of over 9 million cubic feet in the sales of gas for the past six months was announced in the report submitted at the half-yearly meeting of the Sutton (Surrey) Gas Gompany. The balance available for division was £6457; and the Directors recommended the payment of a dividend at the rate of 6 per cent. per annum (less income-tax) for the half year. The quantity of gas sold was 115½ million cubic feet. In addressing the shareholders, the Chairman (Mr. F. Budgen, J.P.) congratulated them on a period of successful business. During the year the price of gas was reduced 2d. per 1000 cubic feet; and he regarded it as very satisfactory that, in spite of this reduction, the receipts from the sale of gas remained about the same. Following the ordinary meeting, there was an extraordinary meeting, at which the Directors were authorized to raise £20,000 further capital by the issue of ordinary stock.

Dover Gas Company.

In the course of his remarks to the shareholders at the half-yearly meeting of the Dover Gas Company, the Chairman (Mr. Willsher Mannering) said the result of the working might be considered satisfactory, having regard to the increased cost of coal and other materials, a decrease of 3½ per cent. in the output of gas, and heavier charges for repairs and renewals. There was a decrease of £470 in sales of gas; but residuals had realized £555 more. After meeting loan charges, &c., there was sufficient to pay the usual dividend and allow of a balance of £50 being added to the surplus profit balance of former years, bringing this up to £721. With regard to the decrease in the sales of gas, there had been a reduced consumption generally throughout the district, especially by the War Department and for the public lamps. Drastic alterations were now being made in the public lighting, by the substitution of electricity for gas; and the Company had received notice from the Corporation to remove upwards of 300 lamps. A test of Kent coal for gas-making purposes was about to be made at the works; and should the results be satisfactory, they might at no distant date be able to obtain their supply from the neighbouring collieries, thereby saving from £3000 to £4000 a year in freight charges alone. The report was adopted, and the payment of a dividend for the half year at the rate of 7½ per cent. per annum (less income-tax) was agreed to. Acknowledgment was made of the services of the Directors and staff, to which the Chairman, the Secretary (Mr. E. C. Fielding), and the Resident Engineer (Mr. E. C. Herring) replied.

Elland Gas Company.—A very successful year's working was reported at the annual meeting of the Elland Gas Company, for though the revenue showed a decrease as compared with the year 1911—£23,583, against £24,155—owing to the reduction in the price of gas from 2s. 6d. to 2s. 4d. per 1000 cubic feet, the dividend had been increased to 7½ per cent., which was the highest in the history of the concern. The total sale of gas showed a decrease of 3,526,300 cubic feet—accounted for largely by strikes and labour troubles. Coal cost £857 more, and wages were higher. From residual products a sum of £927 in excess of that realized during 1911 was shown; and the consumption of gas for public lighting also increased.

Ten Years' Progress at St. Mary Church.—At a meeting of the Torquay Town Council last Tuesday, Mr. F. Chalmers, the Manager of the St. Mary Church Gas-Works, reported on the rapid progress made during the last ten years. The production of gas had risen from 25½ to 45½ million cubic feet, while the sales had increased from 18 to 42 millions; the quantity of gas unaccounted for having fallen from 7½ to 3½ millions, or a decrease from 30 to 7½ per cent. of the gas produced. The make per ton of coal, though slightly lower than last year, was 1300 cubic feet above that of 1902. The number of consumers had also gone up during the ten years from 569 to 1496; while the gas-cookers had increased from 202 to 853.

1913
GAS PROPAGANDA.

Literature.

Our New Season's Booklet is now ready.

Specimens are being sent to all Gas Undertakings.

It is much more comprehensive than is usual, and will be found of great assistance in your 1913 campaign.

May we send you a supply?

The Goods.

Cookers of all sizes and prices to suit the needs and the pockets of all classes.

Cookers embodying all new features of practical value.

Cookers that appeal to the Gas Manager, the Salesman, and the public.

THE "MAIN" COOKERS.

R. & A. MAIN, LIMITED,

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 13, Whitworth Street West, MANCHESTER; 8, Exchange Place, Donegall Street, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

Unlawfully Disconnecting a Meter.

A case has been before the Rochdale Borough Magistrates, in which Walter Butterworth, a plumber, was summoned by the Corporation Gas Department for unlawfully disconnecting a meter from the main-pipe used for conveying gas to his house, and also for unlawfully laying a certain pipe which communicated with the main-pipe. It was explained that two inspectors paid a special visit to defendant's premises, and on going into the cellar found the pipes had been tampered with in such a way that gas could be consumed without passing through, and being registered by, the meter. Butterworth expressed sorrow for the offence, and said he had been doing some experimenting in the cellar, and was tempted to use the gas dishonestly. The Bench imposed a fine of 21s. and costs in the first case. There was no penalty in the second case.

Belfast Gas Profits and the Rates.—A resolution of the Belfast Gas Committee has been agreed to by the Council, to the effect that the Committee should be authorized to grant £10,000 from the profits of the gas undertaking towards the relief of the rates, together with the amount necessary for the payment of dividends and interest on capital expenditure in connection with the City Hall.

Whitby Gas Company.—At the recent annual meeting of this Company, the Chairman (Mr. Freeman Richardson) stated that the receipts for the past half year showed an increase of £400; but that the expenditure was £228 greater, due largely to the higher price the Directors had had to pay for coal, in consequence of the miners' strike. After deducting this amount, however, there was a net gain of £172. Notwithstanding the adverse conditions under which the business of the Company had been carried on during the year, and in spite of the great increase in the cost of coal and other materials, no advance had been made in the price of gas. Dividends at the rate of 3½ per cent. on the original shares and £2 9s. per cent. on the additional and new additional capital (both less tax) were declared for last half year. The balance at the credit of the profit and loss account was £1780.

York City Council and the Gas-Works.—On the consideration, at last week's meeting of the York City Council, of the minutes of a meeting of the Council in committee, at which it was decided to proceed with the Corporation Bill except so far as it related to the purchase of the gas-works (this proposal having been rejected by the ratepayers, as already reported), Alderman Meyer said the balance-sheet of the Gas Company recently issued showed that if the city had sanctioned the purchase of the undertaking, the Council would have been able immediately to effect a reduction of the rates of 4d. in the pound. Alderman Wragge questioned the accuracy of the calculation; but Alderman Meyer, in reply, said that he was convinced that, as year by year they saw the balance-sheets of the Company, the supporters of the purchase proposal would be able to show the citizens that they had thrown away a very large annual reduction of the rates. The minutes were confirmed.

Tunbridge Wells Gas Company.

At the annual meeting of the Tunbridge Wells Gas Company, the Chairman (Mr. W. H. Delves) remarked that the undertaking maintained its steady prosperity. There was a profit of £14,609, as compared with £14,761 for the previous year; while the gas-rental showed an increase of £700. The revenue from public lamps, as usual, exhibited a decrease, and now represented something less than 2 per cent. of the total consumption. He had that day turned up the balance-sheet for the year 1887, a quarter-of-a-century ago. In that year, the price of gas was 3s. 6d. per 1000 cubic feet, and the profit £9246, compared with over £14,000 last year, with the price at 2s. 6d. per 1000 feet. The capital spent in the last twenty-five years was as nearly as possible £70,000. This had enabled them to increase the quantity of gas sold by 200 million feet. They might be well satisfied, therefore, that the expenditure of the capital was not only necessary, but advantageous to the Company. The meeting unanimously adopted the report, which recommended a dividend for the half year to Dec. 31 at the rate per annum of 13 per cent. on the consolidated ordinary stock, 10½ per cent. on the "B" stock, and 10 per cent. on the "C" and "D" stocks. The remuneration of the Directors was increased from £700 to £900 a year. A vote of thanks to the Board and the staff was acknowledged by the Chairman, the Engineer and General Manager (Mr. Andrew Dougall), and the Secretary (Mr. C. F. Catt).

Back Street Lighting at Burnley.—The Burnley Town Council, at their meeting last Wednesday, had under consideration the question of lighting the back streets. Mr. J. P. Leather, the Gas Engineer and Manager, had submitted a report showing that 435 back streets were not lighted; and he estimated the total capital expenditure at £5000, with an annual upkeep cost of £1087. The Council decided that the time had arrived when the back streets should be lighted; and they resolved to make application to the Local Government Board for a loan of £5000 for lamps and work connected therewith.

A Suggested Amalgamation of the Birmingham Gas and Electricity Committees.—A resolution (it, however, failed to pass) was moved at last week's meeting of the Birmingham City Council, to the effect that the General Purposes Committee should consider the advisability of amalgamating the Gas and Electricity Committees, and report thereon within three months. The proposer pointed out that both Committees were engaged in the same business, and each used coal as a raw material, though in different ways; and he asked whether the present system of two Committees pulling in different directions could be of benefit to the consumers. On the other hand, Mr. Ellaway denied that the proposed amalgamation was workable or could be beneficial. It would, he said, simply mean the election of two Sub-Committees responsible to a Committee, instead of two Committees responsible to the Council. Sir Hallewell Rogers (the Chairman of the Gas Committee) also opposed the motion.

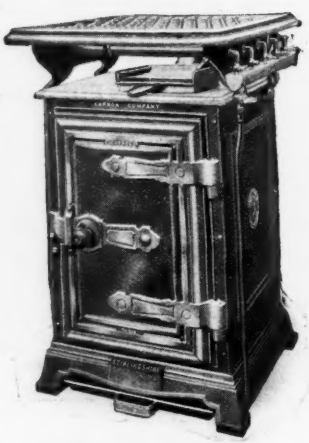
CARRON GAS COOKERS.

MOST Gas Companies prefer to instal a CARRON gas cooker, because this type requires the minimum of maintenance, and have all those little "extras" and improvements that go to the Consumers' satisfaction and the Gas Company's credit.

Royal Appointment.

KING GEORGE has been graciously pleased to grant Carron Company a warrant of appointment as grate manufacturers to His Majesty.

This honour is unique, in that *no other firm engaged in the ironfounding industry has ever been known to have received this appointment.*



BEST GRADE COOKER.

ILLUSTRATED CATALOGUES POST FREE ON REQUEST.

CARRON COMPANY INCORPORATED BY ROYAL CHARTER 1773

WORKS: CARRON, STIRLINGSHIRE, and at Phœnix Foundry, Sheffield.

Silloth Gas-Works Purchase.—A resolution has been passed by the necessary majority by the Holme Cultram Urban District Council to enable them to promote a Bill in the next session of Parliament to empower them to supply gas within the urban district and to purchase the Silloth Gas-Works from the North British Railway Company.

Malvern Gas-Works.—On the recommendation of the Gas Committee, the Malvern Urban District Council have decided to carry out forthwith a portion of the work suggested by Sir Corbet Woodall in his recent report on the gas undertaking. This consists of the replacement of certain mains by others of larger capacity, at a cost not to exceed £1500. Application will be made to the Local Government Board for sanction to borrow the necessary money.

Monte Video Water-Works Company, Limited.—At the ordinary general meeting of this Company on Thursday, the Directors will report that the result of the working in the past year was an increase of £6065 in the net receipts as compared with the year 1911. There is a disposable balance of £110,022; and the Directors propose that it should be appropriated as follows: In payment of a final dividend of 5 per cent. on £850,000 of share capital, making a total of 8 per cent. for the year, free of income-tax, £42,500; to be added to the depreciation fund, £10,000; to the reserve fund, £10,000; and the balance of £47,522 to be carried forward.

Increased Price at Plymouth.—The price of gas at Plymouth has been increased by 2d. per 1000 cubic feet, and the rate to be charged from the date of reading the meters for the current quarter will be the old one of 1s. 9d. A year ago, the Company, who have been aiming at 1s. 6d., took off 2d., and brought down the price to the lowest ever charged in the history of the undertaking. But circumstances have been too strong for them; and the increased cost of coal, oil, and freights has rendered necessary a return to the higher figure. The hope is held out that the present advance will not be permanent; and, in the meantime, it is only to apply to ordinary domestic supplies. No change will be made in the prepayment meters; and the price for gas-engines will remain at the former reduced rate.

Increased Consumption at Weymouth.—It was stated in the report which was adopted at the half-yearly meeting of the Weymouth Consumers' Gas Company that the quantity of gas sold during the six months to Dec. 31 was 73,324,900 cubic feet, which was an increase of 10·2 per cent. over the sales in the second half of 1911. The profit made was £2894; and this, added to the amount brought forward, gave an available balance, after providing for interest on debentures, of £5222, out of which the Directors recommended the payment of a dividend on the ordinary stock for the half year at the maximum rate of 5 per cent. per annum, less income-tax. The Chairman (Mr. J. G. Rowe) said the half year had been a much better one than might have been expected, in view of the unseasonable weather. Before the shareholders separated, the Chairman and Directors, the Engineer and Manager (Mr. Douglas F. Colson), the Secretary (Mr. E. T. Wood), and the other members of the staff were thanked for their services.

Wallasey Rates and Gas Charges.—In the Wallasey Town Council the recommendation of the Finance Committee that the rates should be increased 6d. in the pound has been defeated; but an amendment that the increase be 5d. (making a total levy of 5s. 9¾d.) was carried. A further amendment—which, however, received the support of only four members—was to the effect that the price of gas be increased, apart from prepayment consumers, to 2s. 4d. per 1000 cubic feet, which would be equal to a 4d. rate, and that the price of electricity should be raised ½d. per unit.

Ottoman Gas Company, Limited.—The Directors of this Company, in their report for the half year ended Dec. 31, state that the gas-rental amounted to £24,747, compared with £22,889 for the corresponding six months of 1911, and the net profit was £3645, against £5878. The amount standing at the credit of the profit and loss account is £8336; and it is proposed to pay a dividend at the rate of 7 per cent. per annum on the preference shares (less tax), and at the rate of 10 per cent. per annum on the ordinary shares (tax free), leaving £4842 to be carried forward.

Gosport Water Company.—At the half-yearly meeting of the Gosport Water Company last Wednesday, the Directors' report showed that the revenue in the six months ended Dec. 31 had been £5584, and that the expenditure had left £3034 to be carried to the profit and loss account. The total water-rentals, less voids, were £5550, against £5554 for the corresponding period last year. The profit and loss account showed a balance of £5664; and full statutory dividends were recommended on the 4½ and 5 per cent. preference stocks, 6 per cent. on the 10 per cent. ordinary stock, and 4½ per cent. on the 7 per cent. stock—leaving £3161 to carry forward. The report was adopted.

East Grinstead Gas and Water Company.—At the recent annual meeting of this Company, the accounts presented showed a balance of £8167 available for distribution; and the Directors recommended dividends of £9 10s. per cent. on "A" stock and £6 13s. per cent. on the "B" and "C" shares. Interim dividends of £3 10s. and £2 10s. per cent. were paid in September last; so that £6 and £4 3s. per cent. would be payable. This would (less income-tax) absorb £2222, and leave £5945 to be carried forward. The Chairman (Mr. P. E. Wallis), in moving the adoption of the report, said the sales of gas, residuals, and water were steadily growing. The total increase in the receipts was £1065, which was a very substantial one, and satisfied the Directors well; and he thought it would also satisfy the shareholders. Mr. J. Donaldson seconded the motion; and it was carried unanimously. A vote of thanks having been accorded to the Secretary (Mr. E. Alston Head) and the Engineer and Manager (Mr. D. T. Livesey), it was acknowledged by both gentlemen; the latter giving some interesting comparative figures, showing the growth of the business during his nineteen years' connection with the Company. He mentioned that the unaccounted-for gas had been reduced from 15·83 to 3·7 per cent.; and the make increased from 9000 to 11,425 cubic feet per ton of coal—10,824 cubic feet per ton having been sold last year, compared with 7200 cubic feet in the year before his arrival.

"VOLCANIC" (Powder).——————"VOLCUM" (Paste).

Andrew Stephenson,

Tel. Address:
"VOLCANISM, LONDON."

182, Palmerston House,
Old Broad Street,
LONDON, E.C.

LEST YE FORGET.

The Belfast Corporation have adopted a recommendation of the Gas Committee to grant £10,000 from the profits of the undertaking in relief of the rates, together with £11,400 necessary for payment of interest on the capital expenditure in connection with the City Hall.

The International Nitrogen and Power Company, Limited, has been registered with a capital of £330,000, in £1 and 2s. shares, to carry on the business of manufacturers of, and dealers in, ammonia compounds, salts of ammonia, liquid ammonia, sulphuric, nitric, and acetic acid, acetone, acetate of lime and acetic acid salts, refiners of, and dealers in, raw materials used in such manufactures and the products and bye-products thereof, engineers, &c., and to adopt an agreement with the San Sebastian Development Syndicate, Limited.

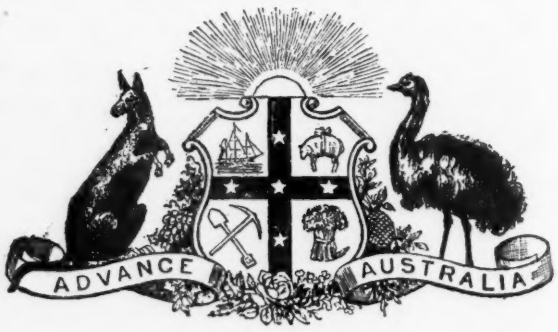
The half-yearly conference of the Richmond Gas Stove and Meter Company, Limited, has just been held at Warrington—Mr. H. M. Thornton presiding. Special interest was centred in the important developments made on the works, and in the organization generally since the last conference. Great activity, it was reported, was being displayed in every section of the works; and the representatives were shown, and expressed satisfaction at, the complete arrangements made for coping with the constantly increasing business of the Company. On the last evening of the conference, the Directors entertained the members to dinner.

At the annual dinner of the Burton (No. 1) Branch of the Amalgamated Society of Gas Workers, Brick Makers, and General Labourers' at which Alderman T. E. Lowe (the Chairman of the Gas and Electricity Committee) and Mr. R. S. Ramsden (the Assistant-Manager of the gas-works) were present, Councillor A. J. Thornley proposed "The Gas-Works Committee and Management. In doing so, he referred to the difference in the conditions that had been brought about during the last two or three years, and testified to the excellent business capabilities of Mr. Ramsden. In responding, Mr. Ramsden congratulated the men on the manner in which they had kept their level-headedness in the turbulent times that had been experienced since they last met two years ago. As to the working of the Insurance Act, he thought that, so far as they were concerned, matters were going well.

The annual report of Messrs. Fletcher, Russell, and Co., Limited, to be submitted at the annual meeting on the 19th inst., states that the profit and loss account, after charging depreciation, debenture interest, and Trustees' and Directors' fees, shows a profit of £17,694, to which is added the balance brought forward from last year of £363; making a total of £18,057, out of which the preference dividend for the half year ended June 30, 1912, of £1500 has been paid, leaving a balance of £16,557. The Directors recommend that a final dividend on the preference shares for the six months to Dec. 31 be paid, absorbing £1500, and that a dividend of 5 per cent. be paid on the ordinary shares for the year, absorbing £5000. They also recommend the payment of a bonus of 2½ per cent. for the year on the ordinary shares, absorbing £2500, and the transfer to the reserve fund of £4500—leaving a carry-forward of £3057.

APPLICATIONS FOR LETTERS PATENT.

4616.—Clayton, J. & R., "Valves." Feb. 24.
4626.—Goulton, W., "Indirect and semi-indirect gas lighting." Feb. 24.
4629.—Kew, H. E., "Charging and discharging of retorts." Feb. 24.
4658.—Rolland, B. M., "Increasing the heating efficiency of stoves." Feb. 24.
4670.—Mason, C. T., "Ignition systems." Feb. 24.
4687.—Suburbaine (Soc. Anon.), "Manufacturing ammonium salts from ammoniacal substances." Feb. 24.
4700.—Hyve, L., "Coal-conveyors." Feb. 24.
4744.—Kent-Johnston, A. G., "Lighting and extinguishing lamps." Feb. 25.
4770.—Mackenzie, J., "Manufacturing sulphuric acid from the sulphur compounds of ammonia freed coal gas." Feb. 25.
4819.—Horn, F. G., "Forcing pipes through earth and withdrawing them." Feb. 25.
4843.—Apparate-Vertriebs-Ges. m. b. H., "Gas-pressure regulators." Feb. 25.
4894.—Boyle, T., "Drilling and connecting branch mains under pressure." Feb. 26.
4909.—Blumberg, R., "Artificial fuel." Feb. 26.
4917.—Simms, F. R., "Electric ignition." Feb. 26.
4979.—Forgues, A., "Pipe-joints." Feb. 27.
5005.—M'Court, C. D., and Radiant Heating, Limited, "Combustion of liquid fuel." A communication from abroad from C. E. Lucke. Feb. 27.
5034.—Gobbe, O., "Regenerators." Feb. 27.
5045.—Brüninghaus, A., "Regenerators." Feb. 27.
5048.—Plaschil, F., and Tögel, H., "Mantles." Feb. 27.
5055.—Cutler, S., jun., "Gas-purifiers." Feb. 27.
5059.—Fallot Incandescent Light Company, Ltd., and Lowe, W. H., "Valves." Feb. 27.
5068.—Brockway, F. G., and Crossley, H., "Gas-purifiers." Feb. 28.
5071.—Roffey, H. P., "Coupling gas-pipes." Feb. 28.
5078.—Townsend, W. W., "Geysers." Feb. 28.
5093.—MacArthur, A., "Gas-compressors." Feb. 28.
5095.—Morriss, H. E., "Geysers." Feb. 28.
5108.—Rehman, H., "Gas-producers." Feb. 28.
5114.—M'Court, C. D., and Radiant Heating, Limited, "Combustion of gaseous fuel." Feb. 28.
5124.—Deutsche Gasglühlicht Akt.-Ges. (Auer-Ges.), "Distance switches." Feb. 28.
5213.—South Metropolitan Gas Company and Chandler, D., "Arc lamps." March 1.



ISSUE OF SHARES AND DEBENTURES.

THE

COLONIAL GAS ASSOCIATION,

LIMITED.

THE Directors of this Association have issued a Prospectus inviting APPLICATIONS for an issue of

5000 Ordinary Shares of £5 each,

and of

60 Five per Cent. Debentures of £100 each,

all at Par.

For the Years ended the 30th of June, 1911 and 1912, a Dividend of Six per Cent. Free of Income-Tax was paid on the existing Ordinary Shares.

The Additional Capital now required is for Extending Works and Mains rendered necessary by the increasing demand for gas, consequent upon the continued growth and development of the townships served by the Company.

Since 1906, the Gas Sales have nearly doubled; and for the six months to the 31st of December, 1912, **the Increase was 31½ per Cent. as Compared with the Corresponding Six Months of 1911.**

The Honourable Sir John W. Taverner, late Agent-General for the State of Victoria, has been elected to the Board.

Prospectuses and Forms of Application, also a copy of the Directors' Report and Statement of Accounts for the year ended June 30, 1912, together with a Report of the Proceedings of the Twenty-Fourth Annual General Meeting, can be obtained on Application to the Secretary, Alfred J. Kingdon, Suffolk House, Laurence Pountney Hill, London, E.C.

The Abertillery Pitch and Benzol Company, Limited, has been registered with a capital of £30,000, in £1 shares, to carry on the business of manufacturers of, and dealers in, chemicals and manures, gas makers, &c.

The Directors of Messrs. Stewarts and Lloyds, Limited, after setting aside £100,000 for depreciation, recommend a dividend of 1s. 6d. per share on the deferred shares, placing £50,000 to reserve, and carrying forward £90,000. Last year 1s. per share was paid on the deferred shares, £70,000 each applied to depreciation and reserve, and £86,500 carried forward.

The South Hants Water Company have entered into a provisional agreement for the purchase of the undertaking of the Bishop's Waltham Water Company; but in view of the auction clause in the purchasing Company's Act, the issue of ordinary shares to the holders of stock of the Bishop's Waltham Company could not be effected. It is, however, intended to find the money by the sale of the purchasers' shares; and it is estimated that the purchase-money will be added to the cost of promoting the Bill.

The Carron Company recently received a communication from the Lord Chamberlain's Office to the effect that the King has been pleased to grant the Company a warrant of appointment as "Grate Manufacturers to His Majesty." This honour, it may be observed, is unique, inasmuch as it has never until now been conferred on any firm engaged in the ironfounding industry. The Company have reason, therefore, to be proud of this distinction. Their works have been visited on many occasions by Crown Heads of Europe, including Nicholas I. of Russia, Prince Leopold Maximilian of Austria, and His late Majesty King Edward the Seventh, when Prince of Wales. It may be added that this old-established Company, whose record extends for over a century-and-a-half, have supplied a large number of their grates to Holyrood, St. James's, and other royal palaces.

The Abingdon Rural District Council have decided to apply for a loan of £2800 for the construction of water-works for the parish of Sutton Courtney.

Messrs. Biggs, Wall, and Co. have secured the contract for the supply and erection of three of their manual "Rapid" charging-machines at the Redditch Gas-Works; also the contract for the supply and erection of the complete sulphate of ammonia plant (including a solid-plate saturator, with Williams and Fenner's outside cracker pipe) for the Taunton Gas-Works.

The annual dinner of the employees of the Wandsworth, Wimbledon, and Epsom Gas Company, which was held recently at the Wandsworth Town Hall, was a highly successful function; there being about 250 present. This was the first gathering of the kind since the amalgamation of the three companies. The Engineer (Mr. H. O. Carr) presided, and proposed the toast of the evening. He mentioned that the Company's ship the *Wandle* had been so successful that the Directors had ordered, and there was in process of building, one much larger. The new ship would carry nearly 1500 tons, which was a very large boat for so high up the Thames. Wishing to pay their Mitcham comrades a compliment, the Company had decided to call the new boat the *Mitcham*. Probably in the years to come more boats would be wanted. There was already a boat in Lloyd's list named *Epsom*, but one might be named *Ewell*. However, whatever the names, more ships would mean more work for Wandsworth men. There would be no question of the prosperity of the Amalgamated Company so long as there was such a splendid Board of Directors, headed by so excellent a gentleman as Mr. Jones, and while there were such a good staff and employees. Mr. Charles W. Braine (the Secretary) responded, and, on behalf of the Company, expressed his thanks for the way in which the toast had been received. The other toasts were "The Visitors," "The Chairman," and "The Secretary."

GAS COMPANIES' STOCK AND SHARE LIST.

The improved condition of affairs on the Stock Exchange to which allusion was made last week did not last long; for factors have since then moved so adversely that the close last Saturday showed a considerable fall in values. Foreign politics, and alarms as to impending money movements in Continental bourses, with attendant stringency at home, were the chief depressing influences; and they were potent enough to infuse no little nervousness. A heavy fall in Consols lighted this up like a beacon. The tone at the opening was not bad, though business remained very restricted. Government issues were fairly firm, and Americans were stronger; but Rails were heavy over the Midland dispute. Movements on Tuesday were mixed—not for the better, on the whole. Consols gave way, for reasons which included the prospect of augmented European armaments; and Rails were still under a cloud. American and Foreign were, however, pretty steady. Wednesday opened brighter, feeling more hopeful of a labour settlement; and this helped Rails. But other markets were mostly dullish and very quiet, not liking the tightness of the Money Market. The same factor depressed Thursday, and Consols fell ¼. Rails were almost inanimate, awaiting the upshot of the Railways Bill and the Midland difficulty. American made a moderate recovery. Friday was a bad day; and everything was as flat as it well could be. Government issues led the way down, and Consols dropped another ¼. Rails were all down—too tired to look up on the Government's surrender of the time-limit in the Railways Bill; and the rest drooped sympathetically. The general depression continued on Saturday. Consols fell another ⅛, closing at 73¼ to 73½ *ex div.*—a fall of ¾ in the week. Rails were unable to revive at the Midland settlement, for which they had waited too long; and the Foreign Market was disturbed. In the Money Market, the stringency steadily tightened day by day, and the position at the close showed no sign of relaxation. Business in the Gas Market, which had been half asleep, woke up considerably to life and action last week. The aggregate of transactions was well above the average; and chief among the undertakings which showed an unusually long line of dealings were the two larger of the three Metropolitan Companies. At the same time, too, the general tendency was firm, in spite of the troubles which affected other markets, and many moderate advances in quotation were scored. In Gaslight and Coke, the ordinary was very active, and changed hands at very steady figures, ranging from 101½ to 102⅜. In the secured issues, the maximum was done at 82, the preference at 96¼ to 98, and the debenture at 75 to 75⅝. South Metropolitan was very busy, and realized from 112½ to 114—a slight improvement upon the figures of the week before. Nothing was done in Commercials. Among the Suburban and Provincial group, Bournemouth "B" marked 16 and 16 1/16 (a rise of ⅛), Brighton ordinary 151½, and Portsea "C" 123½. On the local Exchanges, advanced values were marked in Newcastle, Tynemouth, and Sheffield "B." In the Continental companies, Imperial fetched from 172¼ to 174, ditto debenture 86, Union from 85 to 86½, European from 18⅛ to 18¾, and Tuscan 6. Among the undertakings of the remoter world, Bombay was done at 6½ and 6¾, Buenos Ayres at 93¾, Cape Town debenture at 80 (a rise of 7½), Monte Video at 12 15/16, Primitiva at 6 11/16 to 6⅞, and ditto preference at 5 to 5 5/16.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 11	5	Alliance & Dublin Ord.	75–80	..	6 5 0
374,000	,,	Jan. 16	4	Do. 4 p.c. Deb.	83–86	..	4 13 0
280,000	5	Oct. 11	7½	Bombay, Ltd.	6½–7	..	5 7 2
50,000	10	Feb. 27	15	Bourne-mouth Gas & Water } 10 p.c. B 7 p.c. Pref. 6 p.c.	28½–29½*	..	5 1 8
332,000	10	,,	7		15⅞–16¼*	+¼	4 6 8
75,000	10	,,	6		13¾–14¼*	..	4 4 3
380,000	Stk.	Feb. 27	14	Brentford Consolidated	260–265*	..	5 5 8
330,000	,,	,,	11	Do. New	200–205*	..	5 7 4
50,000	,,	,,	5	Do. 5 p.c. Pref.	113–115*	..	4 6 11
206,250	,,	Dec. 12	4	Do. 4 p.c. Deb.	94–96	..	4 3 4
217,380	Stk.	Feb. 27	11	Brighton & Hove Orig.	205–210*	..	5 4 9
244,200	,,	,,	8	Do. A Ord. Stk.	150–155*	..	5 4 7
530,000	20	Sept. 27	12½	British	45–46	..	5 8 8
120,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. Stk.	89–91	..	4 7 11
245,771	Stk.	—	4	Buenos Ayres 4 p.c. Deb.	92–94	..	4 5 1
100,000	10	—	—	Cape Town & Dis., Ltd.	2–3	..	—
160,000	10	—	—	Do. 4½ p.c. Pref.	4–5	+¼	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	78–83	+7½	5 8 5
157,150	Stk.	Feb. 13	5	Chester 5 p.c. Ord.	107½–109½	..	4 11 4
1,513,280	Stk.	Feb. 27	5/9/4	Commercial 4 p.c. Stk.	103–105*	..	5 4 1
560,000	,,	,,	5¼	Do. 3½ p.c. do.	100–102*	..	5 4 5
475,000	,,	Dec. 12	3	Do. 3 p.c. Deb. Stk.	71–73	..	4 2 2
800,000	Stk.	,,	4	Continental Union, Ltd.	84–87	..	4 12 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	130–132	..	5 6 1
492,270	Stk.	—	5½	Derby Con. Stk.	124–125	..	4 12 0
55,000	,,	—	4	Do. Deb. Stk.	103–105	..	3 16 2
1,002,180	10	Jan. 16	10	European, Ltd.	18½–19½	..	5 2 7
16,415,840	Stk.	Feb. 13	4/17/4	Gas-light and Coke } 4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref.	101–103	..	4 14 7
2,600,000	,,	,,	3½		80–83	..	4 4 4
4,062,235	,,	,,	4		96–99	..	4 0 10
4,674,850	,,	Dec. 12	3	Coke } 3 p.c. Con. Deb.	75–78	..	3 16 11
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	91–93	..	5 7 6
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 11	11	Hongkong & China, Ltd.	16¼–16¾	+¼	6 11 4
131,000	Stk.	Sept. 13	7⅝	Ilford A and C	154–157	..	4 17 1
65,780	,,	,,	6½	Do. B	122–124	..	4 18 9
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.	89–91	..	4 7 11
4,940,060	Stk.	Nov. 14	9	Imperial Continental	171–176	..	5 2 3
1,335,000	Stk.	Feb. 13	3½	Do. 3½ p.c. Deb. Stk.	85–87	..	4 0 6
200,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.	122–125	..	4 16 0
561,000	Stk.	Feb. 27	10	Liverpool United A	218–220*	..	4 10 11
718,100	,,	,,	7	Do. B	155½–157½*	−1	4 8 11
806,083	,,	Dec. 30	4	Do. Deb. Stk.	98–100	..	4 0 0
63,480	Stk.	Jan. 16	3	Maidstone 3 p.c. Deb.	68–70	..	4 5 9
75,000	5	Nov. 28	6	Malta & Mediterranean	4¼–4¾	..	6 6 4
250,000	100	Oct. 1	4½	Met. of Melbourne } 4½ p.c. Deb.	99–101	..	4 9 1
541,920	20	Oct. 30	3½	Monte Video, Ltd.	12⅞–13⅛	+⅛	5 5 8
1,775,892	Stk.	Feb. 27	4½	Newc'tle&G'tesh'd Con.	100⅞–101¼*	+¼	4 9 9
529,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	85–86	..	4 1 5
55,940	10	Feb. 27	7/7/0	North Middlesex 7 p.c.	13–14*	..	5 4 7
300,000	Stk.	Nov. 28	8	Oriental, Ltd.	125–130	..	6 3 1
60,000	5	Sept. 27	10	Ottoman, Ltd.	8¼–8¾	..	5 14 3
60,000	50	Feb. 27	13	Portsea, Island B	125–128*	..	5 1 7
100,000	50	,,	12	Do. C	122–125*	..	4 16 0
249,980	5	Oct. 11	8	Primitiva Ord.	6⅛–7	..	5 14 4
499,960	5	Dec. 30	5	,, 5 p.c. Pref.	5–5½	..	4 15 3
521,600	100	Dec. 2	4	,, 4 p.c. Deb.	96–98	..	4 1 8
346,198	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	92–94	..	4 5 1
275,000	5	Apl. 12	12	San Paulo, Ltd.	13–14	..	4 5 9
150,000	10	Sept. 27	6	Do. 6 p.c. Pref.	11½–12	..	5 0 0
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	49–51	..	4 18 0
135,000	Stk.	Aug. 29	10	Sheffield A	234–236	..	4 4 9
209,984	,,	,,	10	Do. B	231–233	+1	4 6 7
523,500	,,	,,	10	Do. C	230–232	..	4 6 2
90,000	10	Sept. 27	7½	South African	10–11	..	6 16 4
6,429,895	Stk.	Feb. 13	5/9/4	South Met., 4 p.c. Ord.	112½–114½	..	4 15 5
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	74–77	..	3 17 11
209,820	Stk.	Feb. 27	8½	South Shields Con. Stk.	160–162*	..	5 4 11
952,795	Stk.	Feb. 27	6	S'th Suburb'n Ord. 5 p.c.	117–119*	..	5 0 10
60,000	,,	,,	5	Do. 5 p.c. Pref.	115–117*	..	4 5 6
117,058	,,	Dec. 30	5	Do. 5 p.c. Deb. Stk.	118–120	..	4 3 4
594,740	Stk.	Nov. 14	5	Southampton Ord.	102–105	..	4 15 3
120,000	Stk.	Feb. 13	7½	Tottenham A 5 p.c. and B 3½ p.c.	139–142	..	5 2 1
483,940	,,	,,	5¾		114–116	+1	4 19 2
149,470	,,	Dec. 30	4	Edmonton 4 p.c. Deb.	92–94	..	4 5 1
182,380	10	,,	5	Tuscan, Ltd.	6–7	−½	7 2 10
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	96–98	..	5 2 0
236,476	Stk.	Feb. 27	5	Tynemouth, 5 p.c. max.	114–114½*	+1½	4 7 4
255,636	Stk.	Aug. 29	6⅞	Wandsworth B 3½ p.c. 3 p.c. Deb. Stk.	140–143	..	4 16 2
85,766	,,	Dec. 30	3		68–70	..	4 5 9

Prices Marked * are "Ex. Div."

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

GAS ENGINEER (SOUTH AMERICA). No. 5706.
CHARGE OF DISTRIBUTION DEPARTMENT (SOUTH AMERICA). No. 5706.
GAS ENGINEER AND MANAGER. Ilkeston Corporation. Applications by March 15.
SUPERINTENDENT. Cleethorpes Gas-Company.
WORKING MANAGER. Eyemouth Gas Works.
CARBONIZING FOREMAN. No 5707.
CANVASSER AND ADVISER. Hartlepool Gas and Water Company.
JUNIOR FITTER. No. 5702.

Plant, &c. (Second-Hand), For Sale.

LAMP-COLUMNS AND LANTERNS. No. 5708.
PURIFYING MACHINES. No. 5709.

Plant, &c. (Second-Hand), Wanted.

EXHAUSTER AND ENGINE. No. 5704.

Tank Trucks for Hire.

FREDK. G. HOLMES AND CO., Northfleet.

Meetings.

BRITISH GASLIGHT COMPANY. Chief Office, 11, George Yard, E.C., March 19. Twelve o'clock.
OTTOMAN GAS COMPANY. 59 and 60, Gracechurch Street, E.C. March 18. One o'clock.

Stocks and Shares.

BROKEN HILL WATER SUPPLY. London Mart. April 1.
COLONIAL GAS ASSOCIATION. New Issue. See p. 706.
GRAVESEND AND MILTON WATER COMPANY. London Mart. April 1.
HERNE BAY GAS COMPANY. London Mart. April 1.
HORNSEY GAS COMPANY. London Mart. April 1.
HUNGERFORD GAS COMPANY. London Mart. April 1.
NORTH MIDDLESEX GAS COMPANY. London Mart. April 1.
TOTTENHAM AND EDMONTON GAS COMPANY. By Tender. March 18.

TENDERS FOR

Benzol.

INVERNESS GAS DEPARTMENT. Tenders by March 24.

Coal.

DARWEN GAS DEPARTMENT. Tenders by March 31.
DEVONPORT GAS DEPARTMENT. Tenders by March 19.
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General Stores (Lime, Oils, Iron, Buckets, Shovels, Sulphuric Acid, &c.).

INVERNESS GAS DEPARTMENT. Tenders by March 24.
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Meters.

LEEDS GAS DEPARTMENT. Tenders by March 15.

Pipes, &c.

ROCHDALE GAS DEPARTMENT. Tenders by March 19.

Purifier Conversion, &c.

SOWERBY BRIDGE GAS DEPARTMENT. Tenders by March 27.

Tar.

INVERNESS GAS DEPARTMENT. Tenders by March 24.
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See Illustrated Advertisement Feb. 11, p. 428.

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